494 Field Problems (1-5, max 5)
Prereq: major or perm. Research on field problem using standard geographic field methods.

Geological Sciences (GEOL)

101 Introduction to Geology (5) (2N)
Nature and distribution of earth materials and their utilization as natural resources; discussion of earth structure, earthquakes, mountain building, and continental drift; development of landscapes. 4 lec, 2 lab. Not open to students who have had 283.

120 The Mobile Earth (4) (2N)
An examination of the earth's dynamic systems including continental drift, sea-floor spreading, mountain building, volcanic activity, and earth-quakes, and their explanation in terms of plate tectonic theory. Intended for both science and nonscience majors seeking a nontechnical overview of plate tectonics. 4 lec.

130 Geology of the National Parks (4) (2N)
Survey of the geologic features of the national parks of the United States, emphasizing the history of their geologic development. 4 lec.

170 Ore, Energy, and Society (4) (2A)
Survey of a broad array of Earth resources with the goal of examining the impact of those resources on society. The influence of plate tectonic processes and Earth's evolution on resource distribution will be considered. The manner in which technological changes in mineral processing are changing recycling rates and are fostering closer connections between industries, the environment, and society will be explored.

205 Statistical Methods in Geology (4)
Prereq: 101 (spring) *M. Stoertz.* Elementary statistics applied to geologic data. Use of statistical software, spreadsheets, and tools for geologic data analysis (e.g., Rose and Stiff diagrams). Labs will use data sets from branches of geology including hydrology, sedimentology, geophysics, structural geology, and paleontology. 3 lec, 2 lab.

211 Introductory Oceanography (4) (2N)
Survey of physical, chemical, biological, and geological aspects of oceanography. 4 lec.

215 Environmental Geology (4) (2A)
Survey of geological aspects of environmental crisis. Focus on major environmental processes, immediate and extended influence of humans, and prospects for future of physical environment. Presupposes no background in sciences. 4 lec.

221 Earth and Life History (4) (2N)
T. Worsley. A nontechnical survey exploring the 4.5 billion year history of the interaction between life and the environment. Topics include the origin of the earth, the origin and development of life, the origin and evolution of the continents, the history of the atmosphere and ocean, catastrophic extinctions, and the impact of human evolution.

231 Water and Pollution (4) (2A)
The interrelationship between geologic and hydrologic principles and technology as they relate to the use of water resources and the environmental problems associated with its pollution.

255 Historical Geology (4)
Prereq: 101. (winter) *D. Kidder.* An introduction to the geologic history of the Earth, emphasizing the tectonic, stratigraphic, and climatic record of North America. 3 lec, 2 lab.

270 World Mineral Resources (3)
Prereq: soph. Major deposits of metal, nonmetallic, and fuel resources which form backbone of modern industry. Economics and basic geologic controls of mineral production reviewed. 3 lec with demonstrations. Not open to geology majors.

283 Geology for Engineers (4)
(fall) Geologic principles applied to engineering projects and materials. 3 lec, 2 lab. Not open to students who have had 101.

312 Earth Materials and Resources (5)
Prereq: 101, CHEM 122 or 152, nonmajors only. *G. Heien.* An introduction to minerals and rocks, emphasizing common varieties and those important as mineral resources. 3 lec, 4 lab.

315 Mineralogy (5)
Prereq: 101, CHEM 122 or 152. (fall) *G. Heien.* Crystallography, crystal chemistry, and mineralogy, emphasizing mineral identification and formation and association of minerals in different geologic environments. 3 lec, 4 lab.

320 Petrology (4)
Prereq: 315. (winter) *D. Schneider.* Characteristics and origin of igneous, sedimentary, and metamorphic rocks and their identification in hand specimens. 2 lec, 4 lab.

330 Principles of Geomorphology (5)
Prereq: 101. (spring) Basic concepts of origin and development of landforms. Lab study of topographic maps and aerial photographs. 4 lec, 2 lab.

340 Principles of Invertebrate Paleontology (4)
Prereq: 101, 255. (fall). Invertebrate fossils emphasizing theory of their study, morphology, classification, and biologic relationships. 3 lec, 2 lab, field trip.

350 Stratigraphy-Sedimentology (4)
Prereq: 255 or concurrent, 320. (spring) *E. Gierlowski-Kordesch*. Introduction to principles of stratigraphy and sedimentation. Interpretation of depositional environments and their relation to plate tectonic setting. 3 lec, 2 lab.

360 Structural Geology (5)
Prereq: 350. (fall) *D. Nance.* Principles of rock deformation and interpretation of folding and faulting and related topics. Field-oriented structural problems, structural maps, and use of stereographic projections. 4 lec, 2 lab, field trip.

405 Modeling and Computational Methods in Geology (5)
Prereq: CS 220 or 230, MATH 163B or 263B, GEOL 205 or MATH 250. (spring) *D. Lopez.* Applied computer-based mathematical methods in geology. Basic geostatistical concepts. Data analysis, conceptual models, and hypothesis testing in geological problems. Mathematical simulation of geological processes and analysis of solutions. Programming exercises in Fortran and use of software to model processes in hydrogeology, geochemistry, and other fields of geology. 4 lec, 2 lab.

420 Petrography (5)
Prereq: 320, 350, or concurrent. (spring) *D. Schneider.* Petrogenesis of igneous, metamorphic, and sedimentary rocks and their identification via microscopic analysis of thin sections. 3 lec, 4 lab.

427 Water Geochemistry (4)
Prereq: 101, CHEM 123 or 153. *D. Lopez.* (fall) Geochemical origin of major ions in natural waters and the role of fluid-mineral interactions in the evolution of sediments, the ocean, and the atmosphere. Major geochemical cycles. Introduction to thermodynamical equilibrium, kinetics, complexation, oxidation-reduction, and cation exchange. Case studies of important geochemical and environmental issues. 3 lec, 2 lab.

428 Physical Geochemistry (4)
Prereq: 427. *D. Lopez.* (winter, alt.)
Basic principles of physical chemistry for hydrogeologic, environmental, and geologic applications. Topics include adsorption and desorption reactions, chemistry of sulphur and iron, introduction to stable isotopes, transport mechanisms of chemical species, and origin, formation, and migration of oil. 3 lec, 2 lab.

429 Contaminant Geochemistry (4)
Prereq: 101, 427. *D. Lopez.* The main purpose of this course is to provide students with knowledge of the chemical principles and processes involved in the generation and movement of contaminants. It will give students an understanding of the sources, fate, and chemical behavior of some of the most important classes of chemical pollutants. 4 lec.

432 Origin and Classification of Soils (4)
Prereq: 330. Consideration of concept of soil and factors of soil formation, introduction to soil morphology and systems of soil classification, discussion of major soil groups of world and soils of Ohio. 3 lec, 2 lab, field work.

433 Glacial Geology (4)
Prereq: 330, 350. Formation and behavior of glaciers, past and present, consideration of glacial processes, and causes and implications of ice ages. 3 lec, 2 lab, field trips.

435 Quaternary Geology (4)
Prereq: 330, 350. Evaluation of the several geological records of Quaternary environmental change, including geomorphic land forms and sediments, ice cores, soils, organic sediments/ fossils, cave deposits, tree rings, and others. Quaternary geochronology will also be considered.

439 Fluvial Geomorphology (4)
Prereq: 330 or GEOG 315. *G. Springer.* Study if stream processes and human interactions with rivers, including the qualitative and quantitative techniques used to study natural and disturbed streams as presented in lecture and field settings. 4 lec.

443 Advanced Invertebrate Paleontology (5)
Prereq: 340. (winter) *R. Mapes.* Study of selected groups in Phylum Mollusca with details of modern biology, environmental habitats, life modes, etc., applied to fossil record. 3 lec, 4 lab.

446 Earth Systems Evolution (4)
Prereq: 312 or 350; PHYS 201 or 251. (winter) *T. Worsley.* Synthesis of the coupled histories of the earth's interior, surface, and life. 3 lec, 2 lab.

451 Diagenesis (4)
Prereq: 424. *D. Kidder.* Critical view of diagenetic principles using numerous examples. Many topics are selected from recent journal articles. Students read, present, and discuss current literature, as well as writing a term paper. 4 lec.

452 Depositional Environments (4)
Prereq: 350. *D. Kidder.* Advanced coverage of depositional processes and environments. Latter part of course focuses on global sedimentation and events. Students read, present, and discuss current literature, as well as writing a term paper. 4 lec.

453 Physical Limnology (4)
Prereq: 101, CHEM 123 or 153. (Fall) E. Gierlowski-Kordesch. Physical parameters and processes in lake environments, including temperature, light, heat, oxygen, alkalinity, and dissolved ions. Labs include outdoor sampling and measurements. 3 lec, 2 lab.

457 Petroleum Geology (4)
Prereq: 360 or concurrent. (spring) *G Nadon*. Course is designed for geology students at the senior undergraduate and graduate level. It will provide students with an understanding of the basic concepts and processes that govern a) the generation, migration, and trapping of hydrocarbon resources, and b) the fundamentals of exploration for, and exploitation of, these resources. 3 lec, 2 lab.

458 Fluvial Sedimentology (4)
Prereq: 350. (Fall) *G. Nadon*. Provides students with an understanding of how to interpret the depositional environment of sedimentary rocks deposited by rivers and the large and small-scale forces that control the formation and preservation of these deposits.

464 Regional Tectonics (4)
Prereq: 360. (spring) *D. Nance.* Global tectonics and structure of continental cratons and margins, mid-ocean ridges, island arcs, and major orogenic belts. 4 lec.

466 Geodynamics: The Earth's Interior (4)
Prereq: 312 or 320. (spring) *D. Green.* Solid earth geophysics (gravity, magnetics, seismicity, heat flow) and internal structure, dynamics, and evolution of Earth's core, mantle, and crust. 4 lec.

467 Tectonophysics (4)
Prereq: MATH 340, PHYS 202 or 253. (winter) *D. Green.* Quantitative modeling of solid earth physical processes. Physical properties of minerals, rocks, and unconsolidated materials. Modeling of tectonic plate flexure, geothermal heat flow, seismic wave propagation, and fault mechanics. 4 lec.

471 Advanced Environmental Geology (4)
Prereq: 101, CHEM 123 or 153. (fall) *D. Lopez.* Covers the conceptual basis for understanding transport and reaction processes that govern change in many environmental systems. Emphasizes processes occurring at the three major environmental interfaces: air and water, water and the adjoining earthen material, and air and soil. Includes chemical and thermal equilibrium, chemical transport, and transport and transfer of energy across the interfaces. 4 lec.

475A Field Camp I (4)
Prereq: 360. (fall) *D. Schneider, G. Nadon, D. Nance.* Introduction to field mapping techniques based on projects in the Appalachian region This course, only in combination with GEOL 475B (Field Camp II), satifsfies the field camp requirement.

475B Field Camp II: Death Valley (5)
Prereq: 475A. (winter intersession) *D. Schneider, G. Nadon, D. Nance*. Application of field and mapping techniques learned in GEOL 475A, based on projects in the Death Valley region. This course, only in combination with GEOL 475A (Field Camp I), satisfies the field camp requirement.

476 Subsurface Methods (4)
Prereq: 350, PHYS 202 or 253. (winter) *G. Nadon.* Resumé of drilling, sampling, and logging by electric, radioactivity, temperature, and neutron methods as applied to petroleum exploration, water, and engineering projects. 3 lec, 2 lab.

480 Principles of Hydrogeology (4)
Prereq: 101 or 283, MATH 163B or 263B, PHYS 202 or 253. (fall) *M. Stoertz.* Principles governing occurrence, movement, and recovery of water in soil and aquifers. Hydrologic cycle, water budget, hydrology of agriculture, watershed studies, water chemistry, and pollution. 3 lec, 2 lab.

481 Groundwater Flow Modeling (4)
Prereq: 480. (winter) *M. Stoertz.* Steady and unsteady flow to well, analysis of pumping test data, water well design, well development, interference of wells, and design of well fields. 3 lec, 2 lab.

482 Transport Processes in Groundwater (4)
Prereq: 481, MATH 340. (spring) *D. Lopez.* Basic principles and fundamental equations; D.E. of groundwater motion, solution of boundary value problems for different types of aquifers. Analytical and numerical methods in subsurface hydrology with emphasis on finite difference method; digital model. 4 lec.

483 Field Hydrology (6)
Prereq: water resources background. (summer) *K. Edwards, D. Green, D. Lopez, M. Stoertz.* Field training in techniques of hydrology, hydrogeochemistry, and water resources evaluation. 3 wks.

485 Introduction to Applied Geophysics (4)
Prereq: PHYS 202 or 253. (fall) *D. Green.* Introductory course in environmental and geotechnical geophysics. Survey of applied geophysical methods including seismic, gravity, magnetic, electrical, and electromagnetic techniques. 3 lec, 2 lab.

486 Applied Seismology (4)
Prereq: 485. (spring) *D. Green.* Field methods and analysis techniques for seismic characterization of shallow subsurface, multichannel digital data acquisition, generalized reciprocal refraction and common offset refraction techniques as practiced in environmental and geotechnical industries. 4 lec.

489 Advanced Topics in Hydrogeology (1–4)
Prereq: 480, perm. *M. Stoertz, D. Lopez.* In-depth study of an advanced or current topic in hydrogeology, exploring (but not limited to) such areas as karst hydrogeology, fracture-flow hydrology, mine hydrology, unsaturated flow, and inverse modeling. Consult instructor for topics.

490 Seminar in Geology (1–2)
Prereq: perm. Several seminars on specific topics in geological sciences will be offered yearly. It is recommended that all majors participate in at least one seminar.

491 Geologic Studies (1–6, max 12)
Prereq: perm. Staff. Individual or small group independent study arranged with faculty members.

492 Internship (1–15)
Prereq: perm. Provides qualified students with the opportunity to receive credit for work experiece directly related to the geological sciences. Supervised by geological sciences faculty and evaluated by an on-the-job supervisor. A report detailing the internship activities is required before credit is awarded.

495 Senior Thesis (1–5)
Prereq: perm. Independent research project requiring departmental approval of thesis proposal before registering. Required for departmental honors program.

German

See Foreign Languages and Literatures.

Gerontology

Undergraduate Certificate
The Colleges of Health and Human Services and Arts and Sciences cosponsor a Gerontology Certificate Program for students who desire to supplement their undergraduate curriculum with a career in working with or for the elderly. Traditional aging-related content, and the global impact of aging are linked with program initiatives that enable students to appreciate how this growing population affects their own area of study. Health care, social services, recreation, mental health, education, administration, and business are examples of service areas that now employ large numbers of persons working with and for the aging population. This program is open to any undergraduate student in the University. See the College of Health and Human Services section.

Global Learning Community (GLC)

100 The Global Experience (1)
Prereq: Fr or soph. To raise the awareness of a broad range of global issues from an interdisciplinary perspective. To use a problem-based format to address these issues. To foster contacts between American and international students in order to learn about other countries and cultures. To encourage teamwork and collaboration among students and faculty from different disciplines—both face to face and by using Intranet communication software.

201 Global Learning Community Introductory Project (3)
Introduction to project-based learning. Team research and analysis of global issues, with an emphasis on business, communication, and international relations. Perform country, industry,and company analyses; recommend options and solutions; and present ideas orally and in writing. Sample projects: Should McDonalds continue to invest in Russia? Should Wal-Mart expand into Malaysia? Should Amazon.com stay in the French and/or German markets? What should Starbucks' strategy be in Southeast Asia? (2001)

202 Business and Communication in Transitional Socieities (5)
Prereq: soph. (fall and two weeks of winter intersession) Two-stage project focusing on issues and challenges faced by companies, organizations, and nongovernmental organizations in transitional societies. In stage one, teams undertake a country analysis and develop a communications campaign to promote the country to a global media audience. In stage two, work continues in bi-national teams on projects for companies or organizations. Two weeks of winter intersession are spent overseas (Hungary; Ecuador; Czech Republic; Thailand) conducting the project. Sample projects: How can Hungary tell its story through the global media? What story can Ecuador tell through the global media to promote its economic goals? How can Brno tell its story through the media? How can a Bangkok enterprise tell its story through the media?

203 Building Cross-National Alliances (4)
Prereq: 201, 202. (winter) Understanding barriers and opportunities in countries and regions at various stages of development, and the significance of cross-national alliances. Team research and analysis of global ventures in various fields, accounting for relevant legal, economic, political, and social factors. Sample projects: Investigate potential market entry for satellite cell phones in China, Australia, Italy, Japan, Brazil, and Kuwait. Building institutional partnerships for student exchange and study abroad programs in Argentina, Ghana, Morocco, and Turkey. World Music and Social Change.

204 Communication and Development (4)
Prereq: 201, 202. (winter) Research and analysis of how communication can be used to promote development in such areas as agriculture, education, public health, the environment, nation-building, and political and social democracy. Examines changing definitions of development and places emphasis on understanding the historical, social, economic, and political circumstances that impact development and communication strategies used to promote development. Sample projects: Research development needs in a specific country and write a grant proposal for a communication campaign to address these needs.

205 Global Leadership Conference (2)
Prereq: 203, 204. (spring) Teams plan a conference on global issues in business and communication. Selection of a conference theme and topics from proposals submitted by teams. Teams assigned specific planning tasks, such as panels and speakers, budget and funding, logistics, and publicity.

301 Global Economic Trends and Strategic Alliances (4)
Prereq: 205 or perm. (fall) Focuses on how strategic alliances are shaping and changing economic and political relations among the countries of the world, and the impact of such changes on society and culture. Research the development of bilateral trade relations, regional economic groups, and the growth and interdependency of global financial markets. Analysis of how such economic alliances are reflected in geopolitics and international diplomacy, and in cooperative global initiatives in such areas as natural resources, space exploration, education, and sports. Sample project: research global mergers, joint ventures, and alliances in the airline, automotive, and telecommunications industries.