**GEOLOGY (GEOL)**

**GEOL 118  Physical Geology  4 Credit Hours**
An introduction to the study of geologic processes at work in the earth's interior and on its surface. Rocks and minerals, the origin and evolution of the continents, and the gradual and catastrophic processes that shape surface and bedrock features. Three hours lecture, three hours laboratory. (W).

**Corequisite(s): GEOL 118L**

**GEOL 218  Historical Geology  4 Credit Hours**
A generalized study of the history of the earth, with emphasis on the fossil record of life development, the stratigraphic sequence of deposits and paleogeography. Laboratory work will include the study of geologic and topographic maps and fossils of prominent invertebrate phyla. (YR).

**Corequisite(s): GEOL 218L**

**GEOL 303  Geodesy & Cartog. Principles  3 Credit Hours**
Understanding the shape, texture, and structure of the Earth's surface and interior is of critical importance for studying and visualizing the physical world around us. This course focuses on the physical and geographical properties of the Earth's surface, how these properties are measured, and how they are effectively displayed as maps and other visual representations. Surveying, Global Positioning Systems (GPS), and cartographic design both microscales (e.g., meter) and macroscales (e.g., light year) are heavily emphasized. (F, YR)

**GEOL 305  Intro to GIS  4 Credit Hours**
An introductory course that examines the digital representation, manipulation, and analysis of geographic data, with the emphasis on the analytical capabilities that GIS brings solutions to geographic problems. Students will explore and learn GIS principles using ESRI's mapping software, as well as complete a major GIS project.

**Corequisite(s): GEOL 305L**

**GEOL 305D  Intro to GIS  0 Credit Hours**
Required discussion session for GEOL 305.

**Corequisite(s): GEOL 305**

**GEOL 313  Earth Materials  4 Credit Hours**
This course provides a detailed look at the physical and chemical components that constitute the Earth's surface and subsurface. Critical elements of mineralogy, igneous and metamorphic petrology, sedimentology, and stratigraphy are covered. Laboratory sessions allow students to master the use of a petrographic microscope and sedimentary processes, among other related topics. Field sessions allow for students to identify geologic materials in their natural exposed settings. (W, AY)

**Prerequisite(s): CHEM 134 and GEOL 118**

**GEOL 332  Hazardous Waste Management  3 Credit Hours**
Environmental problems associated with solid and hazardous waste. Regulations governing the transportation, storage, and disposal of hazardous waste. Waste management techniques, including reuse, recycling, treatment, incineration, and land disposal. Three hours lecture.

**Prerequisite(s): GEOL 118 or ESCI 275**

**GEOL 340  Remote Sensing  3 Credit Hours**
This course explores the acquisition, processing, and visualization of remotely derived data, with a particular emphasis on local and environmental applications. ENST 340 covers concepts and foundations of aerial and orbital remote sensing, visual interpretation, reflectance and emission spectroscopy, active and passive sensors, topography, and digital image processing software and techniques.

**GEOL 342  Physical Oceanography  3 Credit Hours**
An introduction to physical and chemical oceanography, fundamental marine processes and plate tectonics. Interactions between the oceans and atmosphere and the effect of greenhouse gases on the oceans and the role of physical processes in global climate change will be studied.

**GEOL 350  Geomorphology  4 Credit Hours**
This introductory course is designed to familiarize students with the fundamentals of river behavior and the general principles in fluvial morphology, sedimentation, and hydraulics and stream bank erosion. Applications of these principles are shown utilizing a stream classification system. Problem solving techniques for watershed management, stream restoration, non-point source pollution and integration of ecosystem concepts in watershed management are presented. A combination of both lecture and field applications are provided. (F, AY)

**Prerequisite(s): GEOL 118 or (GEOG 203 and GEOG 204)**

**Restriction(s):**
Can enroll if Class is Junior or Senior
Can enroll if Level is Undergraduate

**GEOL 370  Environmental Geology  3 Credit Hours**
Interactions between people and the physical environment. Geological hazards and natural processes, such as earthquakes, volcanism, floods, landslides, and coastal processes. Relationships between geology and environmental health, including chronic disease, water use and pollution, waste disposal, mineral resources, and energy use. Three hours lecture. (AY).

**Prerequisite(s): GEOL 118**

**GEOL 372  Energy Resources  3 Credit Hours**
Origin and development of fossil fuels (petroleum, coal, natural gas) and of radioactive ores used in nuclear power. Renewable and alternative energy sources, including hydro, solar, wind, biomass, and geothermal power. Environmental impacts of energy use. Three hours lecture. (AY).

**Prerequisite(s): GEOL 118 or ESCI 275 or ESCI 301**

**GEOL 375  Groundwater Hydrology  4 Credit Hours**

**Prerequisite(s): GEOL 118**

**GEOL 377  Field Methods  1 Credit Hour**
A week-long intensive field course dealing with geological field methods and analysis of geological terrains. Use of Brunton compass and clinometer, recognition and identification of geological structures, preparation and interpretation of geological maps, and use of aerial photographs. May be repeated for credit when destination varies. Organizational meeting followed by one-week trip. (YR).

**Prerequisite(s): GEOL 118**

**GEOL 390  Current Topics in Geology  1 to 3 Credit Hours**
A course in special topics current to the field of geology. Topics and format for the course may vary. See current Schedule of Classes. (OC).

**Prerequisite(s): GEOL 118**

**GEOL 440  Advanced GIS Applications  3 Credit Hours**
This course offers an opportunity for students with a background in the fundamentals of geographic information systems (GIS) to apply the analytical capabilities of geospatial technology to model real-world situations in support of decision making. Particular emphasis is given to data development and management, spatial and statistical analyses, customization, and effective visualization.

**Prerequisite(s): GEOL 305 or ESCI 305 or GEOG 305**
GEOL 470  Geodatabase Design & Mgmt  3 Credit Hours
Full Title: Geodatabase Design & Management This course focuses on the design, creation, and management of geodatabases. Topics include database theory, database models, spatial data standards, the collection and pre-processing of geospatial data, topology and topological relationships, metadata creation and storage, and cloud computing. (AY, F)
Prerequisite(s): GEOL 305 or ESCI 305 or GEOG 305

GEOL 475  Contaminant Hydrogeology  3 Credit Hours
Advanced lecture treatment of selected topics in subsurface hydrology including contaminant transport and fate of organic and inorganic constituents, aquifer test analysis, and the use of modeling in the analysis of selected case histories. (AY).
Prerequisite(s): GEOL 375

GEOL 478  Geology of the National Parks  3 Credit Hours
Study of the geology (stratigraphy, structure and geomorphology) of major national parks. Specific parks to be visited varies from year to year, enabling the course to be repeated once for credit. Emphasis is placed on taking field notes, describing rock sequences in outcrop, geologic map reading and aerial photograph interpretation. Special attention is focused on the understanding and development of cratonic sequences, particularly the regional correlation (both lithostratigraphic and time-stratigraphic) of sandstone, shale and limestone facies, and small and large scale geologic features such as folds and faults. Depending on the national park being visited the students may explore paleographic and paleoclimatic evidence from fossils as well as sedimentary structures. This is a field-oriented course requiring a significant amount of physical exertion. (YR)
Prerequisite(s): GEOL 118 and GEOL 218

GEOL 487  Groundwater Modeling  3 Credit Hours
Lecture and laboratory applications of two- and three-dimensional groundwater flow and contaminant transport problems. Visual Modflow, Modpath (-PLOT and SUTRA), MT3D and Surfer will be used to evaluate remedial alternatives (e.g. pump and treat, funnel and gate, or trench and drain systems). EPA's Basins software combined with ESRI's GIS software ArcView will be used to evaluate and compare the Rouge River watershed with other small-scale watersheds in Michigan. (AY)
Prerequisite(s): GEOL 375

GEOL 490  Advanced Topics in Geology  3 Credit Hours
Current topics from various areas in pure and applied geosciences will be reported upon by students, faculty and guest speakers. May include extended field trips. (OC).

GEOL 498  Independent Study in Geology  1 to 3 Credit Hours
Library research and independent study performed under the guidance of a faculty member. Permission of instructor. (F,W,S).

GEOL 499  Laboratory and Field Research  1 to 3 Credit Hours
Directed laboratory or field research performed under the guidance of a faculty member. Four to twelve hours laboratory or field study. Permission of instructor. (F,W,S).

* An asterisk denotes that a course may be taken concurrently.