Spatial aspects of regional development. Examples from classification of geographic data.

Tourism above Michigan. The History, Climatology, and individual experience in research.

Introduction to Quantitative Methods for Geographers and Planners. Fall, 0(3-0) interdisciplinary with the Department(s) of Urban Planning. Department(s): GEO, UP, LA.

Basic quantitative techniques in analysis and classification of geographic data.

Senior Seminar. Spring. 3(0-0) Open only to seniors in Geography. History, philosophy, and methodology of the discipline as it has evolved within academic and social contexts.

Readings in Geography. Fall, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 12 credits.

Geographic Research Problems. Fall, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 16 credits.

Research on selected aspects of Geography.

Field Study. Fall, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 8 credits.

Supervised field study in Geography.

Internship in Geography. Fall, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 8 credits. P: Approval of Department R: Juniors and above.

Individual experience in Geography at an approved agency, firm, or other entity.

Seminar in Physical Geography. Fall, Spring, Summer. 3(3-0) May reenroll for a maximum of 8 credits. P: Consent of instructor R: graduate standing.

Research on topics in physical geography, specifically climatology, geomorphology, soils, and plant geography.

Advanced Quantitative Methods in Geography. Spring. 4(4-0) P: GEO 465.

Advanced methods applied to geographic data. Multiple regression, principle components and factor analysis, discriminant analysis, and related taxonomic methods.

Research Design in Geography. Spring. 3(3-0) R: graduate students GEO and UP Approval of the Department. Research and writing in geography. Identification of geographic problems and their relative importance. Structuring and stating hypotheses. Data acquisition and tests for validity.

Advanced readings in geography. Fall, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 12 credits. R: Graduate students.

Advanced Geographic Research. Fall, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 16 credits. R: Graduate status.

Master's Thesis Research. Fall, Spring, Summer. 1 to 12 credits. May reenroll for a maximum of 30 credits. R: Open only to graduate students in Geography.

Theory and Methods in Geography. Spring. 3(0-0) R: PhD GEO.

Historical development of the geographic discipline within social and intellectual contexts. Current methodological and philosophical approaches to geographic research.

Doctoral Dissertation Research. Fall, Spring, Summer. 1 to 12 credits. May reenroll for a maximum of 36 credits. R: PhD students only Geography.

Geology

Earth Processes and History. Fall, Spring. 4(3-2)

Physical, chemical and biological processes related to the evolution of the Earth. The roles of solar energy, Earth's internal heat and the process of natural selection in controlling these processes.

Engineering Geology. Fall. 4(3-2) R: Not open to freshmen. Open only to College of Engineering students. Not open to students with credit in GLG 201.


Mineralogy and Geochemistry. Fall. 4(3-2) P: CEM 142 or CEM 152.


Vertebrate Life of the Past. Spring. 3(3-0) Interdepartmental with the Department(s) of Zoology.

R: BS 110 or BS 111 or Juniors and above.

B: Not open to students with credit in GLG 433. Evolution and diversity of fossil vertebrates from fish to humans with emphasis on dinosaurs and Pleistocene events.

Mineralogy and Geochemistry. Fall. 4(3-2) P: CEM 141 or CEM 151 OR BS 161.

GLG 321 GLG 322 GLG 327

Vertebrate Life of the Past. Spring. 3(3-0) Interdepartmental with the Department(s) of Zoology.

R: BS 110 or BS 111 or Juniors and above.

B: Not open to students with credit in GLG 433. Evolution and diversity of fossil vertebrates from fish to humans with emphasis on dinosaurs and Pleistocene events.

GLG 322
351*. Structural Geology
Fall. 4(3-2)
P: GLG 201 or GLG 301; GLG 321, MTH 116.
QP: GLG 302 MTH 111  QA: GLG 351

371. Introduction to Geodynamics and Geophysics
Spring. 3(4-0)
P: MTH 132; PHY 183 or PHY 183B or PHY 231 or PHY 231B.
Geophysical methods of studying the structure and dynamics of the earth and planets. Plate kinematics and global geodynamic processes, plate margin processes and evolution, marine geology.
QP: GLG 201 MTH 112  QA: GLG 375 GLG 479

411*. Hydrogeology
Fall. 4(3-2)
P: MTH 116 R: Not open to freshmen and sophomores.
Principles of the source, occurrence and movement of groundwater emphasizing geologic factors and controls.
QP: MTH 108 OR MTH 111. QA: GLG 411

412*. Glacial and Quaternary Geology
Spring of odd-numbered years. 3(2-2)
Interdepartmental with the Department(s) of Geography.
P: GLG 201 OR GLG 301 OR GEE 406
R: Jr. and above
Glacial and Quaternary geology of the world with emphasis on the United States. Laboratory studies stress glacial processes. One weekend field trip required.
QP: GLG 201 QA: GLG 413

421*. Environmental Geochemistry
Fall. 4(3-2)
P: GLG 201 or GLG 310; CEM 141 or CEM 151.
Natural and anthropogenic processes affecting environmental chemistry with emphasis on the water cycle. Chemical equilibria, kinetics, geochemical cycling, and rain, carbon dioxide and the greenhouse effect. Historical perspectives and future concerns.
QP: GLG 200 OR GLG 201 OR GLG 310 CM 151 QA: GLG 421

422*. Organic Geochemistry
Fall. 3-6
P: CEM 152; GLG 201 or GLG 301; PHY 183 or PHY 183B or PHY 231 or PHY 231B
Organic geochemistry applied to global cycling of organic matter and diagenesis. Evaluation of the fate of bulk organic matter and individual compounds in the environment.
QP: CRM 152 GLG 201 OR GLG 201 OR GLG 301 PHY 183 or PHY 183B or PHY 231 or PHY 231B

431*. Stratigraphy and Paleontology
Spring. 4(3-2)
P: GLG 201 or GLG 301
Depositional environments through geologic time; facies, events, correlation. Historical paleontology and evolution: biostratigraphy, biogeography and paleoecology.
QP: GLG 202 GLG 338 GLG 392 QA: GLG 338 GLG 346

433. Vertebrate Paleontology
Fall of even-numbered years. 4(3-2)
Interdepartmental with the Department(s) of Zoology.
P: ZOL 228 R: Not open to students with credit in GLG 331. Approval of department.
Fossil vertebrates with emphasis on evolution of major groups. Modern techniques of collection, identification and interpretation of fossils.
QP: ZOL 429 QA: GLG 430

434*. Evolutionary Paleobiology
Fall of odd-numbered years. 4(3-2)
Interdepartmental with the Department(s) of Zoology.
P: BS 110 or GLG 201
Patterns and processes of evolution known from the fossil record including speciation, phylogeny, extinction, heterochrony and biogeography.
QP: GLG 338 ZOL 389ZOL 445 QA: GLG 438 GLG 536

461*. Petrology
Spring. 4(3-2)
P: GLG 331
Petrology of igneous, metamorphic and sedimentary rocks. Thin section studies of rocks and rock suites from classic areas.
QP: GLG 352 AND GLG 353 AND GLG 351 QA: GLG 363 GLG 392

471*. Applied Geophysics
Fall of odd-numbered years. 4(3-2)
P: MTH 133 or concurrently; PHY 194 or PHY 195 or PHY 203 or concurrently. R: Not open to freshmen and sophomores.
QP: GLG 375 MTH 214 PHY 230 PHY 239 QA: GLG 474

472*. Principles of Modern Geophysics
Fall of even-numbered years. 3(3-0)
P: MTH 335; PHY 184 or PHY 184B.
Theory of solid-earth geophysics including geochronology, geothermics, geomagnetism and paleomagnetism, geodesy and gravity, seismology, and travel-time seismology.
QP: MTH 310 PHY 289 QA: GLG 477 GLG 877

481*. Reservoirs and Aquifers
Spring of even-numbered years. 4(3-2)
P: P: GLG 431 or concurrently; GLG 461.
Principles of the origin and evolution of porous media. Permeability and porosity of sediments and sedimentary rocks. Computing techniques for evaluating reservoirs and aquifers.
QP: GLG 392 QA: GLG 485

491*. Field Geology - Summer Camp
Summer. 3(0)
P: GLG 301, GLG 431, GLG 461. R: Open only to Geology majors.
QP: GLG 351 ZOL 389 ZOL 345 GLG 346 QA: GLG 344 GLG 344A GLG 344B

499*. Independent Study in Geological Sciences
Fall, Spring. 1 to 3 credits. May reenroll for a maximum of 8 credits.
R: Open only to Geology juniors and seniors. Approval of department.
Advanced individual study of special topics in the geological sciences.
QA: GLG 490H

801*. Seminar in Geological Sciences(MTC)
Fall. Spring. 1 to 6 credits. May reenroll for a maximum of 9 credits.
R: Masters and Ph.D. only.
Seminar relating to current research in geochemistry, geophysics, geodynamics, hydrogeology, paleoecology, petrology, sedimentology, structural geology and tectonics.
QA: GLG 810

801A*. Seminar in Geochemistry
Fall. Spring. 1 to 4 credits. May reenroll for a maximum of 9 credits.
R: Masters and Ph.D. only
Seminar relating to specific areas and recent developments in geochemistry, including aqueous, biologic and mineralogic aspects.
QA: GLG 824

801B*. Seminar in Geophysics and Geodynamics
Fall. Spring. 1 to 4 credits. May reenroll for a maximum of 9 credits.
P: GLG 571 OR GLG 471 OR GLG 472 R: Masters and Ph.D. only
Seminar relating to applied, solid-earth, and theoretical geophysics, global and regional geodynamics, and recent developments in plate tectonics, marine geophysics, and polar earth sciences.
QP: GLG 474 GLG 479 QA: GLG 811 GLG 813 GLG 815

801C*. Seminar in Hydrogeology
Fall. Spring. 1 to 4 credits. May reenroll for a maximum of 9 credits.
P: GLG 411 OR GLG 421 R: Masters and Ph.D. only
Seminar relating to the occurrence, movement and composition of groundwater in various geologic settings.

801D*. Seminar in Paleobiology
Fall. Spring. 1 to 4 credits. May reenroll for a maximum of 9 credits.
R: Masters and Ph.D. only OR approval of department.
Seminar relating to invertebrate, vertebrate and plant paleobiology.
QA: GLG 816

801E*. Seminar in Petrology
Fall. Spring. 1 to 4 credits. May reenroll for a maximum of 9 credits.
P: GLG 481 R: Masters and Ph.D. only
Seminar relating to current topics in igneous petrology.
QA: GLG 823

801F*. Seminar in Sedimentology
Fall. Spring. 1 to 4 credits. May reenroll for a maximum of 9 credits.
R: Masters and Ph.D. only
Seminar relating to recent developments in deposition and diagenesis of sedimentary rocks.
QP: GLG 491 GLG 492 QA: GLG 817 GLG 818 GLG 819 GLG 820 GLG 821

801G*. Seminar in Structural Geology and Tectonics
Fall. Spring. 1 to 4 credits. May reenroll for a maximum of 9 credits.
R: Masters and Ph.D. only
Seminar relating to rock deformation and major lithospheric structure.
QA: GLG 814 GLG 822

821*. Aqueous Geochemistry
Fall of odd-numbered years. 3(0-0)
P: PHY 429 OR CEM 383 OR CE 681 OR CSS 655 OR FW 472 R: Masters and Ph.D. only
Controls on the chemical and isotopic nature of water (fresh, marine, brine) and its solutes. Data acquisition and synthesis, chemical modeling and the evolution of water resources.
QP: GLG 457 QA: GLG 894

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822*. Biogeochemistry
Fall of even-numbered years. 3(3-0)
P: 12 credits in CEM or BS; 6 credits in
GLG R: Masters and Ph.D. only OR approval of
department.
Carbon and nutrient cycling in the natural environ-
ment; cell and anoxic processes; flows of carbon in
lacustrine, marine, and terrestrial ecosystems; development of the carbon cycle over geologic time.

823*. Isotope Geochemistry
Spring of even-numbered years. 3(3-0)
P: CEM 161 and 162; PHY 103 and 104,
OR PHY 211 and 212. R: Masters and Ph.D. only
Fundamentals of isotope behavior, fractionation, and
terrestrial, marine, and global ecosystems.

831*. Quantitative Paleobiology
Spring of even-numbered years. 3(2-2)
Interdepartmental with the
Department(s) of Zoology,
P: GLG 431 OR ZOL 342 R: Masters and
Ph.D. only
Analysis of selected paleobiological problems using
terrestrial and marine, and global ecosystems.

861*. Evolution of the Crust and Mantle
Fall of even-numbered years. 3(3-0)
P: GLG 461 R: Masters and Ph.D. only
Origin and evolution of the Earth's crust and mantle.

862*. Igneous Petrology
Fall of odd-numbered years. 4(3-2)
P: GLG 461 R: Masters and Ph.D. only
Origin and evolution of igneous systems. Relationship
of igneous activity to tectonic setting.

863*. Mineral-Water Interactions
Spring of odd-numbered years. 4(3-2)
Interdepartmental with the
Department(s) of Crop and Soil
Sciences.
R: Masters and Ph.D. only OR CSS
Mineralogy and petrology of rock-water reactions in
sedimentary, and geological cycles, including rock and mineral weathering, soil
formation, genetic and burial diagenesis of sediments
and sedimentary rocks, and metamorphism.

871*. Seismology
Spring of odd-numbered years. 3(3-0)
P: MTH 234, PHY 104 R: Masters and
Ph.D. only
Seismological theory, earthquakes, quantitative
terrestrial and geological cycles, including rock and mineral weathering, soil
formation, genetic and burial diagenesis of sediments
and sedimentary rocks, and metamorphism.

876D*. Special Problems in Paleobiology
Fall, Spring, Summer. 1 to 4 credits.
May reenroll for a maximum of 6
credits.
R: Masters and Ph.D. only
Individual study on problems in applied
geomorphology or paleontology.

878A*. Special Problems in Geophysics and Geodynamics
Fall, Spring, Summer. 1 to 4 credits.
May reenroll for a maximum of 6
credits.
R: Masters and Ph.D. only
Individual study on problems in geophysics and
global environments.

878D*. Special Problems in Geophysics and Geodynamics
Fall, Spring, Summer. 1 to 4 credits.
May reenroll for a maximum of 6
credits.
R: Masters and Ph.D. only
Individual study on problems in applied
geodynamics or geophysics.

878E*. Special Problems in Sedimentology
Fall, Spring, Summer. 1 to 4 credits.
May reenroll for a maximum of 6
credits.
R: Masters and Ph.D. only
Individual study on problems in sedimentology.

888F*. Special Problems in Stratifictgence and Geology
Fall, Spring, Summer. 1 to 4 credits.
May reenroll for a maximum of 6
credits.
R: Masters and Ph.D. only
Individual study on problems in stratigraphic analysis.

GERMAN

101*. Elementary German I
Fall. 4(4-1)

102*. Elementary German II
Fall. 4(4-1)

200*. Second Year German Review
Fall. 4(4-1)

201*. Second Year German I
Fall. 4(4-0)

202*. Second Year German II
Fall. 4(4-0)

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