886. Methods and Modeling in Regional Science
Spring 3(3-0) Interdepartmental with Resource Development. Administered by Resource Development.
P: RD 461.
Regional research techniques. Economic base analysis, input-output analysis, mathematical programming, and econometric and simulation analysis.

888. Research Design in Geography
Spring 3(3-0) Interdepartmental with Resource Development and Urban Planning.
P: BC 220, GEO 265, GEO 415 or RD 461.
Techniques for regional research: economic base analysis, input-output analysis, mathematical programming, and econometric and simulation analysis.

890. Advanced Readings in Geography
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Approval of department. Advanced independent readings.

892. Advanced Research in Geography
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 12 credits in all enrollments for this course. Advanced independent research.

895. Master's Thesis Research
Fall, Spring, Summer. 1 to 12 credits. A student may earn a maximum of 30 credits in all enrollments for this course. R: Open only to graduate students in Geography.

896. Theory and Methods in Geography
Spring 3(3-0) R: Open only to Ph.D. students in Geography. Historical development of the discipline within social and intellectual contexts. Current methodological and philosophical approaches to geographic research.

897. Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 90 credits in all enrollments for this course.

GEOLOGICAL SCIENCES GLG
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201. The Dynamic Earth
Fall, Spring, 4(3-2) R: Not open to students with credit in GLG 301.
Physical and chemical processes related to the past, present and future behavior of the earth system, and the energy systems that drive these processes. A study of the earth's materials, the earth's surface and the earth's interior.

202. Physical and Biological History of the Earth
Fall, Spring, 4(3-2) P: GLG 201.

301. 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. Principles of geology as applied to civil engineering practice. Mines, rocks, surficial and internal processes, mitigation of destructive geological processes. Air photos, topographic-geologic maps, cross sections.

302. Geology of Michigan
Spring 3(3-0) P: GLG 201 or GLG 301 or ISP 203.
Integration of the geological evolution of Michigan with its social and economic development.

303. Oceanography
Fall 4(4-0) P: CEM 142 or CEM 152 or PHY 232 or PHY 234, PHY 253 or CEM 141, PHY 251 or CEM 151, PHY 183 or CEM 151, PHY 331.
Physical, chemical, biological, and geological aspects of oceanography: ocean circulation, waves, tides, air-sea interactions, chemical properties of ocean water, ocean productivity, shoreline processes, and sediments.

319. Introduction to Earth System Science
Fall 3 credits. Interdepartmental with Entomology, Botany and Plant Pathology, Zoology, and Sociology. Administered by Entomology.
P: Completion of one course in biological or physical science.
Systems approach to Earth as an integration of chemical, geological, geophysical, and biological components. Global dynamics at a variety of spatio-temporal scales. Sustainability of the Earth system.

321. Mineralogy and Geochemistry
Fall 4(3-2) P: GLG 201 or GLG 301 or concurrently, CEM 142 or CEM 152; MTH 124 or MTH 152.

331. Vertebrate Life of the Past
Spring 3(3-0) Interdepartmental with Zoology.
P: BS 110 or BS 111 or juniors and above. R: Not open to Zoology majors. Not open to students with credit in GLG 413.
Evolution and diversity of fossil vertebrates from fish to humans with emphasis on dinosaurs and Pleistocene events.

332. Social Impact of Paleobiology
Spring 3(3-0) P: ISB 200 or ISP 203 or GLG 201 or BS 110; one ISS and one JAR course. R: Completion of Tier 1 Writing Requirement.
Social impact and influence of paleobiological thought and discoveries, from early ideas on the origins of fossils to evolution as a dominant force shaping the design of organic life. Involvement of paleobiology in social Darwinism, eutonian humanism, evolutionary mysticism, and conflicts with creationists.

337. Plants Through Time
Spring of odd-numbered years. 3(3-0) Interdepartmental with Botany and Plant Pathology. Administered by Botany and Plant Pathology.
P: BS 110 or BOT 105 or GLG 261 or LBS 114. R: Juniors and above. Evolutionary history of plants, the development of ecosystems, and the use of plant fossils in the reconstruction of ancient environments and climate.

351. Structural Geology
Fall 3(3-0) P: GLG 361, MTH 116.
Structural geology. Mechanical behavior and kinematic history of the lithosphere. Stress and strain. Deformation features such as folds, faults and microstructure. Methods of analysis and interpretation. One weekend field trip required.

361. Petrology (W)

371. Plate Tectonics (W)
Spring 4(3-2) P: MTH 116; PHY 183 or PHY 183B or PHY 231 or PHY 231B. R: Completion of Tier 1 writing requirement. Geophysical methods of studying the structure and dynamics of the earth's crust. Plate kinematics and global geodynamic processes, plate margin processes and evolution, marine geology.

411. Hydrogeology
412. Glacial and Quaternary Geology
Spring, 4(3-2) Interdepartmental with Geography.
P: GLG 201 or GLG 301 or GEO 306 or GEO 408. R: Not open to freshmen and sophomores.
Glacial and Quaternary geology with emphasis on North America and Europe. Laboratory focuses on glacial processes. One weekend field trip required.

419. Advanced Earth System Science
Spring, 5 credits. Interdepartmental with Entomology, Botany and Plant Pathology, Zoology, and Sociology. Administered by Entomology.
P: ENT 319
Systems science theory applied to analysis of the biological, geological, physical, and social causes and consequences of global changes. Issues of sustaining the Earth system.

421. Environmental Geochemistry
Spring, 4(3-2)
P: GLG 201 or GLG 301; CEM 141 or CEM 151.
Natural and anthropogenic processes affecting environmental chemistry with emphasis on the water cycle. Chemical equilibria, kinetics, geochemical cycling, acid rain, carbon dioxide, heavy metals, toxic organics, global change and the greenhouse effect.

422. Organic Geochemistry (W)
Fall, 3(3-0)
P: CEM 141 or CEM 152 or CEM 153; GLG 201 or GLG 301; PHY 152B or PHY 301 or PHY 312B. R: Completion of Tier I writing requirement.
Organic geochemistry applied to global cycling of organic matter and diagnosis. Evaluation of the fate of bulk organic matter and individual compounds in the environment.

423. Environmental Geosciences
Spring, 3(3-0)
P: GLG 201 or GLG 301.
Application of geological sciences to environmental issues ranging from global warming to geological hazards such as earthquakes.

426. Biogeochemistry
Summer, 3 credits. Given only at W.K. Kellogg Biological Station. Interdepartmental with Microbiology, Crop and Soil Sciences, and Zoology. Administered by Microbiology.
P: BS 110 or BS 111, CEM 143 or CEM 251.
Integration of the principles of ecology, microbiology, geochemistry, and environmental chemistry. Societal applications of research in aquatic and terrestrial habitats.

431. Sedimentology and Stratigraphy (W)
Spring, 4(3-2)
P: GLG 361. R: Completion of Tier I writing requirement.
Sediments, sedimentary rocks, sedimentary processes, and depositional environments through geologic time. Facies and events correlation. Fossils as tools in stratigraphy and environmental analysis. Biostratigraphy, paleocology and taphonomy.

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

434. Evolutionary Paleobiology
Fall, 4(3-2) Interdepartmental with Zoology.
P: BS 110 or GLG 201.
Patterns and processes of evolution known from the fossil record including speciation, phylogeny, extinction, heterochrony and biogeography.
894. Special Problems in Paleobiology
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
R: Open only to graduate students in Geological Sciences. Approval of department.
Individual study on vertebrate, invertebrate, and plant paleobiology.

895. Special Problems in Petrology
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
R: Open only to graduate students in Geological Sciences. Approval of department.
Individual study on current problems in petrology.

896. Special Problems in Sedimentology and Stratigraphy
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
R: Open only to graduate students in Geological Sciences. Approval of department.
Individual study on problems in sedimentology and stratigraphy.

101. Elementary German I
Fall, Spring. 4(4-1)
P: GRM 101, GRM 200 or designated score on German placement test. Not open to students with credit in GRM 150 or GRM 200.
Further study of German language, civilization, and culture for beginning students. Continued work on all language skills with emphasis on speaking.

150. Review of Elementary German
Fall, Spring. 4(4-1)
R: Open only to students with high school credit in German SAT II. Not open to students with credit in GRM 101 or GRM 102.
Review of first-year college German for students who had German in high school and who need to strengthen communication skills, vocabulary, grammar, and pronunciation before study at the 200 level.

102. Elementary German II
Fall, Spring. 4(4-1)
P: GRM 102 or designated score on German placement test. Not open to students with credit in GRM 150 or GRM 200.
Further study of German language, civilization, and culture for beginning students. Continued work on all language skills with emphasis on speaking.

103. Advanced German Language and Culture I
Fall, Spring. 3(3-0)
P: GRM 202 or designated score on German placement test.
Work on advanced speaking, listening comprehension, reading, and writing skills through intensive work with authentic texts dealing with contemporary issues relating to the German-speaking world. Selected review of grammar and syntax.

104. Advanced German Language and Culture II
Fall, Spring. 3(3-0)
P: GRM 301.
Further work on advanced speaking, listening comprehension, reading, and writing skills, through intensive work with original texts dealing with contemporary issues relating to the German-speaking world.