

Descriptions—Genetics of Courses

- 842. Population Genetics, Genealogy and Genomics**
Fall. 3(3-0) Interdepartmental with Forestry; Animal Science; Crop and Soil Sciences; Fisheries and Wildlife; and Horticulture. Administered by Forestry. RB: Pre-calculus, basic genetics
Population genetic processes underlying patterns of molecular genetic variation. Genealogical approaches to the study of genomic diversity, phylogenetic reconstruction, and molecular ecology.
- 851. Molecular Entomology**
Fall of odd years. 3(3-0) Interdepartmental with Entomology. Administered by Entomology.
Analysis of molecular processes unique to insects, and their potentials for genetic engineering.
- 880. Laboratory Rotation**
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 Ph.D. majors in Genetics.
Participation in research with faculty members.
- 999. Doctoral Dissertation Research**
Fall, Spring, Summer. 1 to 12 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to Ph.D. students in Genetics.

GEOGRAPHY

GEO

Department of Geography College of Social Science

- 113. Introduction to Economic Geography**
Fall, Spring. 3(3-0)
Spatial distribution of resources, population, enterprise, trade, consumption, and production. Interaction of those distributions at local to global scales.
- 151. Cultural Geography**
Fall. 3(3-0)
Systematic approach to the spatial distribution of cultural features, processes, and relationships.
- 203. Introduction to Meteorology**
Fall. 3(3-0)
Fundamentals of meteorology. Energy balance, adiabatic processes, horizontal motion, cyclogenesis, and severe weather.
- 206. Physical Geography**
Fall, Spring. 3(3-0)
Geographic and functional interrelationships within the physical environment: Earth-sun relationships, weather, climate, soils, vegetation and landforms (terrain characteristics).
- 206L. Physical Geography Laboratory**
Fall, Spring. 1(0-2) P: GEO 206 or concurrently.
Geographic aspects of weather, climate, soil, vegetation, and terrain. Interpretation and application of maps and remotely sensed imagery.

- 221. Introduction to Geographic Information**
Fall, Spring. 3(2-2)
Principles and methods of spatial data collection, handling, analysis, and display. Introduction to remote sensing, geographic information systems, and cartography.
SA: GEO 223, GEO 225
- 230. Geography of the United States and Canada**
Fall, Spring, Summer. 3(3-0)
Regional analysis. Evolution and status of environmental, demographic, economic, and sociocultural patterns and processes.
- 233. Geography of Michigan**
Fall of odd years. 3(3-0)
Physical and cultural geography of Michigan.
- 259. Geography of Recreation and Tourism**
Fall of even years. 3(3-0)
Cultural, physical, and biotic factors affecting the distribution of recreation and tourism resources and participation. U.S. and international examples and case studies.
- 306. Environmental Geomorphology**
Spring. 3(3-0)
Relationships of running water, weathering, gravity, ice, waves, wind, and biota (including humans) to terrain and soils. Evolution of landscapes. Classical and modern interpretations.
- 313. Introduction to Data Analysis for Urban and Regional Planners**
Fall. 3(2-2) Interdepartmental with Urban Planning. Administered by Urban Planning. P: CSE 101 or CSE 131; UP 201.
Data gathering analysis, information presentation, and basic techniques of urban planning. Application of related computer programs and software.
- 314. Methods for Investigation of Urban Systems**
Spring. 3(2-2) Interdepartmental with Urban Planning. Administered by Urban Planning. P: UP 313.
Models, approaches, and techniques for urban and regional problem analysis and plan formulation.
- 324. Remote Sensing of the Environment**
Fall, Spring. 4(2-4)
Features and interpretation methods of remotely sensed imagery, especially black-and-white and color infrared airphotos. Basic features of radar, thermal, and multispectral imagery. Interpretation for agriculture, archaeology, fisheries, forestry, geography, landscape architecture, planning, and wildlife management.
SA: GEO 224
- 326. Thematic Cartography**
Fall. 4(2-4) P: GEO 221.
Principles and techniques of map making. Decision making in designing thematic maps.
SA: GEO 223

- 335. Geography of Latin America**
Fall. 3(3-0) R: Not open to freshmen. Completion of Tier I writing requirement.
Physical and human geography of Latin America. Current development issues, especially people-environment interaction in urban and rural areas. Topics include migration, urbanization, and industrialization.
- 336. Geography of Europe**
Fall of odd years. 3(3-0) R: Not open to freshmen. Completion of Tier I writing requirement.
Major regions and nations, including their physical resources, peoples, political structures, and economies.
- 337. Geography of East Asia**
Spring. 3(3-0) R: Not open to freshmen. Completion of Tier I writing requirement.
Spatial patterns and processes of physical and human geography in China, Japan, Korea, and Taiwan. Emphasis on development problems, especially since 1950.
- 338. Geography of Africa**
Fall. 3(3-0) R: Not open to freshmen. Completion of Tier I writing requirement.
Physical and human geography of Africa. Current development issues, especially people-environment interaction in urban and rural areas. Topics include drought, agricultural patterns, hunger, rural development, migration, and urbanization.
- 401. Geography of Plants of North America**
Spring of even years. 3(3-0) R: Not open to freshmen and sophomores.
Geography of Plants in North America with emphasis on the East. Related ecological principles, soils, and post-cretaceous geologic history. Some field instruction.
- 402. Agricultural Climatology**
Fall of even years. 3(3-0) Interdepartmental with Biosystems Engineering. P: MTH 116. R: Not open to freshmen and sophomores.
Relationships between climate and agriculture in resource assessment, water budget analysis, meteorological hazards, pests, crop-yield modeling, and impacts of global climate change.
SA: AE 402
- 403. Microclimate and Its Measurement**
Fall of odd years. 4(3-3) Interdepartmental with Biosystems Engineering. Administered by Biosystems Engineering. P: MTH 116 R: Not open to freshmen or sophomores.
The climate near the Earth's surface. Energy balance, thermal radiation exchange, heat fluxes, temperature sensors, wind speed and direction, humidity and evapotranspiration and their measurement.
SA: ATM 836, GEO 836
- 404. Synoptic Climatology**
Fall. 4(4-0) P: GEO 203.
Global climate patterns and their controls. Relationship between upper air flow and weather in the northern hemisphere westerlies.

- 405. Applied Synoptic Climatology: Principles and Methods**
Spring of odd years. 4(3-2) P: GEO 404 or approval of department; MTH 116.
Dynamic and thermodynamic principles of atmospheric science applied to the development and evolution of extratropical cyclones. Laboratory sessions include analysis of current observations and satellite imagery.
- 407. Regional Geomorphology of the United States**
Fall of odd years. 3(3-0) P: GEO 306 or GLG 201 or GLG 412 or ISP 203.
Geomorphic characteristics of physiographic regions of the United States.
- 408. Soil Geomorphology Field Study**
Fall. 4(2-4) P: CSS 210 or GEO 306 or GLG 201 or GLG 412 or ISP 203. R: Not open to freshmen and sophomores.
Common geographic relationships among soils, landforms, and vegetation in lower Michigan. Description, analysis, and genesis of soils and landscapes. Surficial processes. Field trips required.
- 412. Glacial and Quaternary Geology**
Spring. 4(3-2) Interdepartmental with Geological Sciences. Administered by Geological Sciences. P: (GLG 201 or GLG 301 or GEO 306 or GEO 408) R: Not open to freshmen or sophomores.
Glacial and Quaternary geology with emphasis on North America and Europe. Laboratory focuses on glacial processes. One weekend field trip required.
- 413. Urban Geography**
Fall. 3(3-0) Interdepartmental with Urban Planning. P: GEO 113. R: Not open to freshmen and sophomores.
Theories and models of urban spatial form. Underlying structures and processes. Socio-spatial dimensions of modern urbanism. Differentiation and locational conflict in residential, commercial, and industrial space.
- 414. Geography of Transportation**
Fall of odd years. 3(3-0) Interdepartmental with Urban Planning. P: GEO 113. R: Not open to freshmen.
Spatial principles of transportation. Theories of interaction, network structures, and location-allocation models. Role of transport and transport planning.
- 415. Location Theory and Land Use Analysis**
Fall. 3(3-0) Interdepartmental with Urban Planning. P: GEO 113. R: Not open to freshmen.
Classical and neoclassical, static and dynamic models of industrial location and spatial organization. Land rent theory. Central place theory. Multi-locational organization. Growth transmission.
- 418. The Ghetto**
Fall of odd years. 3(3-0) Interdepartmental with Urban Planning. P: GEO 413 or SOC 375 or UP 201 or ISS 320 or MC 343 or MC 384 or approval of department. R: Not open to freshmen and sophomores.
Analysis of the ghetto including its spatial organization and structure. Distribution of racial and ethnic populations. Emphasis on U.S. cities.
- 419. Applications of Geographic Information Systems to Natural Resources Management**
Spring. 4(2-4) Interdepartmental with Fisheries and Wildlife; Forestry; Park, Recreation and Tourism Resources; Resource Development; and Biosystems Engineering. Administered by Fisheries and Wildlife. P: (GEO 221)
The application of geographic information systems, remote sensing, and global positioning systems to integrated planning and management for fish, wildlife, and related resources.
- 423. Map Production and Design**
Spring. 4(2-4) P: GEO 221.
Manual and automated techniques. Design solutions, map planning, overlay construction, user issues, typography, color theory, and color selection.
- 424. Advanced Remote Sensing**
Fall. 4(3-2) P: GEO 324. R: Not open to freshmen and sophomores.
Interaction of solar radiation with the atmosphere, lithosphere, hydrosphere, and biosphere. Introductory digital image processing. Earth-resources satellite sensors, data products, and applications. Radar and thermal remote sensing.
- 425. Geographic Information Systems**
Spring. 4(3-2) Interdepartmental with Urban Planning. P: GEO 221.
Technical and theoretical issues in the design, evaluation, and implementation of geographic information systems for research and application.
- 428. Digital Terrain Analysis**
Fall of even years. 4(3-2) P: GEO 324 or GEO 424; GEO 221. R: Open only to juniors or seniors.
Theoretical and technical issues of collection, management, analysis, and display of terrain data. Application of photogrammetry, geographic information systems, and cartography.
- 432. Environmental Ethics in Geography (W)**
Fall. 3(3-0) P: Completion of Tier I writing requirement. R: Open only to juniors or seniors.
Ethical dimensions and scientific bases of environmental and spatial controversies arising from landscape valuation, control, and alteration.
- 434. Spatial Aspects of Regional Development**
Spring of odd years. 3(3-0) P: GEO 113, or GEO 151, or GEO 230, or GEO 233, or GEO 335, or GEO 336, or 337.
Spatial patterns and processes associated with regional development in selected world areas.
- 459. Tourism in Regional Development**
Spring of odd years. 3(3-0) P: GEO 259 or PRR 213.
The role of tourism in regional development. Examples from Michigan, and the United States and other nations. Environmental considerations.
- 463. Introduction to Quantitative Methods for Geographers and Planners**
Fall. 3(3-0) Interdepartmental with Urban Planning. P: Completion of University mathematics requirement. R: Open only to majors in Geography, Urban Planning, and Landscape Architecture.
Quantitative techniques in the analysis and classification of spatial data.
- 478. Urban Transportation Planning**
Spring. 3(3-0) Interdepartmental with Urban Planning. Administered by Urban Planning. P: UP 201, UP 314. R: Open only to majors in Geography or Urban and Regional Planning or approval of department.
Principles of decision-making in urban transportation planning. Demand and supply analysis, social and environmental impacts, implementation programs. Use of computer models.
- 480. Senior Seminar (W)**
Fall. 3(3-0) R: Open only to seniors in Geography. Completion of Tier I writing requirement.
History, philosophy, and methodology of the geographic discipline as it has evolved within academic and social contexts.
- 490. Independent Study**
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Approval of department.
Supervised individual study in an area supplementary to regular courses.
- 492. Geographic Research Problems**
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Not open to freshmen and sophomores. Approval of department.
Supervised original research on selected aspects of geography.
- 495. Field Study**
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Not open to freshmen and sophomores. Approval of department.
Supervised field study in geography.
- 498. Internship in Geography**
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Open only to juniors and seniors. Approval of department.
Individual experience in geography in an approved organization.
- 806. Advanced Geomorphology**
Spring of even years. 3(3-0)
Advanced study in geomorphology, surficial processes and soils.
- 809. Seminar in Physical Geography**
Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course.
Review of research on topics in physical geography such as climatology, geomorphology, soils, or plant geography.
- 813. Seminar in Urban and Economic Geography**
Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. P: Two of GEO 413, GEO 414, GEO 415, GEO 416, GEO 417, GEO 418.
Review of research on selected topics in urban and economic geography.

Descriptions—Geography of Courses

- 814. Applied Research Methods for Planning and Development**
Spring. 3(2-2) Interdepartmental with Urban Planning. Administered by Urban Planning. P: UP 813. R: Open only to graduate students in Urban and Regional Planning, Public Administration, and Geography.
Techniques in urban and regional planning analysis. Forecasting models. Methods of urban project evaluation.
- 819. Spatial Epidemiology and Medical Geography**
Spring of even years. 3(3-0) Interdepartmental with Epidemiology. Administered by Epidemiology. P: EPI 810. R: Open only to master's students in the Epidemiology major or approval of department.
Concepts, techniques, and utilization of spatio-epidemiologic analyses for human health.
SA: HM 819
- 823. Map Automation**
Fall of even years. 3(2-2)
Use of computers in cartography. Cartographic algorithms, interpolation, and line generalization. Program intelligence. Cartographic data bases.
- 825. Geoprocessing**
Fall of odd years. 4(4-0)
Integration of digital remote sensing data, geographic information systems, spatial analysis, and expert systems in solving research problems. Class research project.
- 826. Seminar in Cartography and Geoprocessing**
Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course.
Review of research in cartography, geographic information systems, and remote sensing.
- 832. Environmental and Natural Resource Law**
Fall. 3(3-0) Interdepartmental with Resource Development; Agricultural Economics; Crop and Soil Sciences; and Forestry. Administered by Resource Development. P: RD 430.
Origin and development of environmental law. Theories of power, jurisdiction, sovereignty, property interests, pollution, and other bases for legal controls of natural resources. Common law and constitutional limitations on governmental power.
- 850. Seminar in Regional Geography**
Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course.
Review of research on contemporary geographic issues in different world regions.
- 854. Economics of Planning and Development**
Spring. 3(3-0) Interdepartmental with Urban Planning. Administered by Urban Planning. P: UP 801.
The physical urban environment and local economic development.
- 865. Advanced Quantitative Methods in Geography**
Spring. 4(4-0) P: GEO 465.
Statistical and mathematical approaches. Multiple regression, principal components and factor analysis, discriminant analysis. Related taxonomic methods.
- 867. Methods and Modeling in Regional Science**
Spring of even years. 3(3-0) Interdepartmental with Resource Development; and Urban Planning. P: EC 820, GEO 865; GEO 415 or RD 461.
Techniques for regional research: economic base analysis, input-output analysis, mathematical programming, and econometric and simulation analysis.
- 886. Research Design in Geography**
Spring. 3(3-0)
Research and writing in geography. Identification of geographic problems and their relative importance. Structuring and stating hypotheses. Data acquisition and tests for validity.
- 890. Advanced Readings in Geography**
Fall, Spring, Summer. 1 to 8 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 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course.
Advanced independent research.
- 899. 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.
- 986. 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.
- 999. Doctoral Dissertation Research**
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 36 credits in all enrollments for this course.

GEOLOGICAL SCIENCES

GLG

Department of Geological Sciences College of Natural Science

- 201. The Dynamic Earth**
Fall, Spring. 4(3-2) 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 or ISP 203)
Origin of the Earth. Differentiation of the Earth's core, mantle and crust. Lithospheric tectonics over geologic time. Origin and evolution of the Earth's hydrosphere, atmosphere and climate. Origin and evolutionary history of biological life. Interactions of life with the Earth's endogenic and exogenic systems.
- 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 141 or CEM 142 or CEM 151 or CEM 152 or CEM 181H or CEM 182H or LBS 165) and (PHY 183 or PHY 183B or PHY 193H or PHY 231 or PHY 231B or PHY 231C or LBS 164)
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(3-0) 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 geochemical, geophysical, biological and social 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 concurrently or GLG 301) and (CEM 142 or CEM 152 or CEM 182H or LBS 266) and (MTH 124 or MTH 132 or LBS 118)
Geochemical properties and processes in the origin, modification, structure, dynamics and history of Earth materials. Crystallography and crystal chemistry. Mineral classification and identification.
- 332. Social Impact of Paleobiology**
Spring. 3(3-0) P: (ISB 200 or ISP 202 or ISP 203 or GLG 201 or BS 110 or LBS 144) and completion of Tier I writing requirement and one ISS course and one IAH course.
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, evolutionary humanism, evolutionary mysticism, and conflicts with creationists.
- 335. Plants Through Time**
Spring of odd years. 3(3-0) Interdepartmental with Botany and Plant Pathology. Administered by Botany and Plant Pathology. P: BS 110 or BOT 105 or GLG 201 or LBS 144. 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. 4(3-2) P: (GLG 202 and GLG 361) and (MTH 116 or LBS 117) RB: Introductory physics.
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.