807. Special Problems
Fall, Winter, Spring, Summer. 2 to 5 credits. May re-enroll for credit with a maximum of 10 credits.

809. Natural Resources Economics
Winter. 3(3-0) Approval of department. Interdepartmental with the Resource Development Department.

Applications of economic analysis to natural resource problems.

828. Seminar
Fall, Winter, Spring. 1 to 3 credits. May re-enroll for a maximum of 12 credits if a different topic is taken.

Critical study and discussion of advanced forestry topics including natural resource economics, forest biology, and natural resource program budgeting.

830. Physiological Genetics
Winter. 3(3-0) Approval of department. Interdepartmental with Crop Science.

Physiological bases for genetic variation in higher plants including adaptive physiology, quantitative genetics, growth correlations, biochemical genetics, hybrid physiology, and genecology.

850. Administering the Public Land Agency
Spring. 4(4-0) 450 or approval of department.

Case studies of administrative problems in land management agencies. Students are organized as teams and prepare team reports on specified aspects of each case.

851. Public Program Budgeting
Fall. 3(3-0) Approval of department. Interdepartmental with the Resource Development Department.

Survey of the federal government's planning-programming-budgeting-system, stressing executive branch budget decision-making and budget administration in the natural resource bureaus.

855. Research Methods
Fall. 3(3-0) Approval of Department. Interdepartmental with and administered by the Resource Development Department.

Research techniques applicable to management, and policy-oriented natural resource investigations. Analysis of project designs; preparation of project proposals. Evaluation of representative published research studies.

899. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

980. Simulation Models in Natural Resource Management
Fall, Winter of odd-numbered years. 3(3-0) Approval of department. Interdepartmental with and administered by the Resource Development Department.

The role of simulation models in developing management strategies. Applications of computer simulation in natural resources. Modeling of decision systems in natural resources management.

999. Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

FRENCH

See Romance Languages

GEOGRAPHY GEO

College of Social Science

Courses are classified as follows:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Cultural-301, 307, 404, 801, 901.</td>
<td>Cultural Geography Courses</td>
</tr>
<tr>
<td>Economic-213, 309, 409, 412, 413, 438, 454, 806, 807, 809, 835, 906.</td>
<td>Economic Geography Courses</td>
</tr>
<tr>
<td>Biological-330, 395, 495, 496, 497, 408, 418, 420, 421, 440, 441, 459, 460, 461, 463, 464, 812, 912.</td>
<td>Biological Geography Courses</td>
</tr>
<tr>
<td>Historical-310, 810, 910.</td>
<td>Historical Geography Courses</td>
</tr>
<tr>
<td>Independent Research-400H, 411, 818, 899, 918, 999.</td>
<td>Independent Research Courses</td>
</tr>
<tr>
<td>Medical-470, 970, 970.</td>
<td>Medical Geography Courses</td>
</tr>
<tr>
<td>Political-416, 806, 906.</td>
<td>Political Geography Courses</td>
</tr>
<tr>
<td>Population-320, 838, 934.</td>
<td>Population Geography Courses</td>
</tr>
<tr>
<td>Quantitative Methods-427, 428, 811.</td>
<td>Quantitative Methods Courses</td>
</tr>
<tr>
<td>Regional-204, 300, 405, 406, 407, 408, 418, 420, 421, 440, 441, 459, 460, 461, 463, 464, 812, 912.</td>
<td>Regional Geography Courses</td>
</tr>
<tr>
<td>Theory and Philosophy-130, 824, 825, 924, 927.</td>
<td>Theory and Philosophy Courses</td>
</tr>
<tr>
<td>Urban-318, 402, 403, 805.</td>
<td>Urban Geography Courses</td>
</tr>
<tr>
<td>Visual and Media Techniques-222, 223, 324, 424, 426.</td>
<td>Visual and Media Techniques Courses</td>
</tr>
</tbody>
</table>

150. Geography of Selected Current Problems
Fall. 3(3-0)

The geographic perspective is used to examine U. S. and world problems of major concern such as international conflicts, environment quality, spatial change, and economic development.

200. Resource Ecology and Man
For course description, see Interdisciplinary Courses.

203. Introduction to Study of the Moon
For course description, see Interdisciplinary Courses.

204. World Regional Geography
Fall, Winter, Spring, Summer. 4(4-0)

Man’s relationship with natural and cultural environments.

206. Physical Geography
Fall, Winter, Spring, Summer. 4(4-0)

Principal earth surface elements of physical geography including weather, climate, landforms, soils, water and biologic resources, in their genetic, distributional and functional interrelationships.

206L. Physical Geography Laboratory
Fall, Winter, Spring. 1(0-2) 306 or concurrently.

Laboratory study of geographic aspects of map interpretation, aerial photographs, weather, climate, soils, landforms, and vegetation.

213. Economic Geography
Fall, Winter, Spring, Summer. 3(3-0)

Emphasis on world preparation of economic and business activities, stressing factors of location and economic concepts of locational change.

222. The World of Maps
Fall. 3(3-0).

Discussion of types, practical applications, and sources of maps.

223. Introduction to Cartography
Fall, Winter, Spring. 4(4-0)

Principles and techniques of constructing maps and other graphic devices. Types of map reproduction, application of quantitative methods to cartography.

280. Perspectives on Geography
Spring. 2(2-0)

Introduction to the profession of geography for majors.

300. Geography of North America
Fall, Winter, Summer. 4(3-0)

Human and physical geography of North America, north of the Mexican border.

301. Geography of Culture
Spring. 4(4-0)

A systematic discussion of cultural geography, stressing cultural processes and relationships.

307. Geography of Environmental Quality
Fall. 4(3-0)

Identification of the physical, cultural and psychological factors which constitute human environments, and how they vary and may be modified or controlled.

309. Geography of Recreation
Winter. 3(3-0)

Recreational land use and services in the United States, including analysis of resources basic to such land use and their distribution.

310. Historical Geography of the United States
Spring, Summer. 4(3-0)

Reconstruction of geographies of the United States as they existed in the past.

318. Cities of the World
Fall, Winter, Spring, Summer. 4(3-0)

A cross-cultural examination of cities, their historic growth, regional functions, and internal dynamics.

390. Geography of Population
Fall. 4(3-0).

A geographical analysis of world population including demographic characteristics, growth rates, and distributional patterns.

324. Remote Sensing: Airphoto Interpretation
Fall, Winter. 4(3-4) Sophomores.

Use of aerial photographs in the identification and interpretation of physical and cultural features of the terrestrial environment. Includes principles of photogrammetry.
411. Contemporary Problems of South Asia
   For course description, see Interdisciplinary Courses.

412. Geography of Agriculture
   Winter. 4(3-0).
   Analysis of the nature and world distribution of agricultural activities and settlements.

413. Geography of Manufacturing
   Winter. 4(3-0) 213 or Juniors.
   Evaluation of the place to place variation of different types of manufacturing industries, phasing the changes in regional structure of manufacturing and industrial location theory.

415. Field Techniques in Geography
   Fall, Spring. 4(1-7) May re-enroll for a maximum of 8 credits. Approval of department.
   Geographic field work including recognition and classification of natural and cultural features, interview procedures, and preparation of reports and maps based on field data.

416. Man's Geo-Political World
   Winter, Summer. 4(3-0) 204 or Juniors.
   Spatial aspects of territoriality, boundaries, voting patterns, government programs, formation of political units, political development and integration, and environmental policy.

418. Geography of Polar Regions
   Winter of even-numbered years. 4(3-0) 204 or approval of department.
   The arctic, including the continental fringe lands of North America and Eurasia, and the Antarctic. Emphasis on exploration, physical geography, and recent developments in settlement and resource use.

419. Systematic Geography of Africa
   Winter. 4(3-0) 204 or approval of department.
   Systematic study of Subsaharan Africa: geomorphology, air mass climatology, vegetation, agriculture, historical, political, and economic geography.

421. Regional Geography of Africa
   Spring. 4(3-0) 430 or approval of department.
   Analysis of selected countries and regions of Subsaharan Africa.

422. Computer Techniques in Geography
   Spring. 3(0-3) 427 or GTT 421 and approval of department.
   The preparation of computer maps and the application of the computer to the development and testing of models in geography.

429. Landforms of North America
   (3 credit) Winter. 4(0-3) 306, GLG 201 or approval of department.
   Description and interpretation of the surface configuration of the United States and Canada. Will concentrate on Eastern and Western U.S.A. during even and odd years, respectively.

430. Climates of the World
   Spring. 4(3-0) 206 or approval of department.
   Regional analysis of the world's weather and climate.

431. Landform Analysis
   Fall. 4(3-0) 506, GLG 201 or approval of department.
   Treatment of selected aspects relating to surface configuration.

432. Biogeography
   Spring. 4(3-0) 205 or approval of department.
   A systematic introduction to the principles and analysis of biotic geography.

435. Spatial Analysis and Location Theory
   Spring. 4(3-0) 213 or approval of department.
   Location principles and theories of economic activities, including methods of regional analysis.

436. Planimetric Cartography
   Spring. 4(2-4) 324, 428 or approval of department.
   Principles, theory and practice of precision map compilation and manuscript development.

440. Geography of Western Europe
   Winter. 4(3-0) 204 or approval of department.
   Geographic analysis of physical and human resources of Western Europe (Scandinavia, British Isles, Benelux, Germany, France, and Switzerland). Emphasis on spatial problems.

441. Geography of Eastern and Southern Europe
   Spring. 4(3-0) 304 or approval of department.
   Physical and human geography of Eastern and Mediterranean Europe.

450. Geography of Australia and Pacific Islands
   Winter of odd-numbered years 4(3-0) 204 or approval of department.
   Physical and cultural geography of Australia, New Zealand, Melanesia, Micronesia, and Polynesia.

451. Climatology
   Fall. 4(3-0) 506 or approval of department.
   A systematic treatment of climatological processes and their geographic implications.

454. Geography of Water
   Fall. 4(3-0) 306 or 213.
   Geographic aspects of global water resources, their utilization patterns, and the role of water in agricultural and industrial production.
458. Trends in Geographic Education
Winter. 4(3-0)
Selected trends and problems in geography and their implications for the schools.

460. Geography of the Soviet Union
Fall. 4(3-0) 204 or approval of department.
Physical and human geography of the U.S.S.R., including its role in world affairs.

461. Geography of South Asia
Fall. 4(3-0) 204 or approval of department.
A geographical analysis of the physical environment and human societies of India, Pakistan, and Ceylon.

462. Geography of East Asia
Fall. 4(3-0) 204 or approval of department.
Physical and cultural geography of eastern Asia—China and Japan.

463. Geography of Southeast Asia
Spring. 4(3-0)
A geographical analysis of the culture, political, economic and physical environment of mainland and insular Southeast Asia.

464. Geography of Middle East and North Africa
Winter. 4(3-0)
Socio-political and economic geography and physical environment of southwest Asia and Northern Africa.

470. Geography of Health and Disease
Fall. 4(3-0) 204 or approval of department.
Application of geographical concepts of space and environment to study of health-related problems.

478. Canadian-American Studies
For course description, see Interdisciplinary Courses.

480. Senior Seminar
Spring. 2(2-0) Senior majors or approval of department.
Current developments in geographic research and theory.

501. Seminar in Cultural Geography
Fall. 3(3-0) Approval of department.
Theory, methodology, and techniques in cultural geography.

505. Seminar in Urban Geography
(804) Spring. 2(3-0) Approval of department.
Selected research topics on the geography of the city.

506. Seminar in Agricultural Geography
Spring. 3(3-0) Approval of department, 412.
Research problems on selected topics of agricultural geography.

507. Seminar in Manufacturing Geography
Spring. 3(3-0) Approval of department, 412.
Research problems on selected topics of industrial location.

508. Seminar in Political Geography
Spring. 3(3-0) Approval of department.
Spatial analysis of selected political phenomena.

509. Seminar in Transportation Geography
Winter. 3(3-0) Approval of department, 469.
Selected research topics.

510. Seminar in Historical Geography
Winter. 3(3-0) Approval of department.
Approaches in research in historical geography.

511. Advanced Quantitative Methods in Geographic Research (814.) Winter. 3(3-0) Approval of department, 427.
Statistical and mathematical approaches to spatial distributions and areal data.

512. Regional Seminar
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 9 credits. Approval of department.
Selected research topics in regional geography.

518. Readings in Geography
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 credits. Approval of department.

825. History and Philosophy of Geography
Fall, 3(3-0) Approval of department.
Analysis of the monographic and serial literature dealing with the theory and evolution of geographic science.

826. Research Design in Geography
Winter, Spring. 3(3-0) Approval of department.
Formalized approach to research and writing in geography: Identification of geographic problems and their relative importance, structuring and stating hypotheses, data acquisitions, and tests for validity.

827. Contemporary Theory and Methodology in Geographic Research (818.) Spring. 3(3-0) Approval of department.
Examination of the forward edges of geographic research, particularly with respect to its relation to other disciplines, scientific methodology in general, and the evolution of geography as a professional scholarly discipline.

834. Seminar in Physical Geography
Winter, Spring. 3(3-0) May re-enroll for a maximum of 9 credits. Approval of department.
Analysis of classical and contemporary problems in physical geography treated as follows: climatology (winter), biogeography (spring), geomorphology (spring).

835. Seminar in Location Theory
Fall. 3(3-0) Approval of department, 435.
Recent developments and research in location analysis and regional science.

836. Population Geography Seminar
Spring. 3(3-0) Approval of department.
Studies of particular topics and problems in population geography.

838. Interdisciplinary Seminar on Africa
For course description, see Interdisciplinary Courses.

850. Advanced Field Techniques
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 6 credits.
Instruction and practical training in the selection, data-gathering, on-site analysis, and presentation of geographic field problems.

858. Seminar in Geographic Education
Spring. 3(3-0) Approval of department.
Treatment of selected topics in geographic education.

870. Seminar in Medical Geography
Winter. 3(3-0).
Spatio-environmental analysis of selected health problems.

899. Research
Fall, Winter, Spring. Variable credit. Approval of department.

901. Problems in Cultural Geography
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 6 credits. Approval of department.
Special research problems.

902. Problems in Physical Geography
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 6 credits.
Supervised research in specific topics of physical geography.

906. Problems in Economic Geography
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 6 credits. Approval of department.
Special research problems.

908. Problems in Political Geography
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 6 credits. Approval of department, 418.
Special research problems.

910. Problems in Historical Geography
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 credits. Approval of department.
Special research problems in historical geography.

912. Independent Study in Regional Geography
Fall, Winter, Spring. Variable credit. May re-enroll for a maximum of 9 credits. Approval of department.
Individual studies in regional geography.

918. Problems in Geography
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 9 credits. Approval of department.
Research on specific geographical problems.

934. Problems in Population
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 9 credits. Approval of department.
Special research problems.
GEOLOGY

College of Natural Science

200. The Geology of Man's Environment
Fall, Winter, Spring, Summer. 3(3-0)
Not open to Geology majors.
The relation of geological processes and Earth materials to man. The nature and evolution of the Earth and life upon it. Man's exploitation of the non-renewable resources of the Earth.

200L. Laboratory—Geology of Man's Environment
Fall, Winter, Spring, Summer. 1(3-0) or concurrently.
The geological reasoning concerning the nature and evolution of the Earth.

201. Earth Processes
Fall, Winter, Spring. 4(4-2) Credit will be given for only one of the following: 200, 201, 306.
Physical processes concerning evolution of Earth and its environment. Interaction of energy and matter through time. Laboratory stresses interpretation of processes through studies of geologic data.

202. Evolution of the Earth
Fall, Winter, Spring. 4(4-2) 200, or 201, or 306.
Integration of physical, chemical and biological processes from which man's present environment has evolved; problems and controversies in the development of ideas of geologic and organic evolution.

203. Introduction to Study of the Moon
For course description, see Interdisciplinary Courses.

205. Oceanology—The Marine Environment and Man
Fall. 3(3-0)
Physical oceanography, including origin, hydrology, chemical, geological properties, and environmental quality of the oceans. Marine industries are emphasized including resource utilization and pollution.

221. Minerals, Rocks and Fossils
(SBE). Spring 3(2-2) Not open to majors.
Description, occurrence and identification of minerals, rocks, fossils, and additional features of geologic interest. Contribution of geology to general science teachers and other earth science interest groups.

271. Geophysics and the Earth
Fall: 3(3-0) 200 or 201 or 306 or approval of department.
Basic concepts used in geophysics, including description of the Earth and its interior, methods of exploration for minerals and energy resources. Contributions of physical methods to understanding our terrestrial environment.

281. Mineral Resources of the Earth
Fall. 3(3-0)
Mineral resources, their genesis, occurrence, exploitation and use. Future projections from historic and current developments. The impact on international affairs and the welfare of nations. Field trip.

282. Energy Resources of the Earth
Winter. 3(3-0)
World energy resources of petroleum, coal, and atomic fuel. Social, political, economic, and environmental problems of fuels.

285. Introductory Earth Chemistry
Winter. 3(3-0) 200 or 201 or 306, or approval of department.
Descriptive qualitative analysis of minerals by blow pipe and other methods.

335. Fossil Plants, Their History and Paleoeocology
Winter. 3(3-0) One course in geology or botany or biology or approval of department. Inte~ldepartmental with the Botany and Plant Pathology Department.
History of plants through geologic time, their forms and evolution; how and where fossils are found, identified and reconstructed; their use in determining ancient geographic patterns, paleoenvironments, paleoclimates and community structure. Field trip.

344. Field Geology—Summer Camp
Summer. 3(0-0) 202. Credit. 446, 437, 451 recommended.
Methods and techniques of geological surveying and mapping. Field interpretation of geological phenomena in igneous, metamorphic and sedimentary rocks in northern Michigan and Wisconsin.

A. Introduction to Field Techniques
3 credits.
Introduction to field techniques with stress on those that apply to sedimentary rocks. Stratigraphic correlation.

B. Methods of Geological Mapping
4 credits.
Plane table surveys, aerial photo and reconnaissance mapping. Examination and interpretation of structural and stratigraphic relationships in igneous and metamorphic rocks.

C. Geologic Interpretation of Selected Areas
2 credits.
Independent mapping and interpretation.

363. Lithology
(SBE). 3(3-2), 432. Spring, 4(3-4) 321.
Processes that form igneous, metamorphic and and sedimentary rocks, origin, distribution, variation and occurrence of rock. Study of rock properties in the field, laboratory, and with the microscope.

400H. Honors Work
Fall, Winter, Spring. Variable credit. Approval of department.

401. Environmental Geology
Spring of odd-numbered years. 3(3-0) 200, or 201, or 306 MTH 113, or approval of department.
Quantitative solution of geological problems applied to environmental planning and management, including surface and ground water waste disposal, urban geology, and methods for prediction of geologic hazards and resources.

411. Hydrogeology
Spring. 3(3-0) One term of geology and trigonometry.
Principles of the source, occurrence, and movement of ground water. Surface and subsurface investigations of ground water and elementary ground water hydrology.

413. Glacial Geology
Spring. 3(3-2) 201.
Geological aspects of glaciers and glaciation. Theories of ice ages through geologic time. Origin and development of glacial geomorphic features. Character and chronology of the Pleistocene. Laboratory techniques with field trips to observe glacial materials and features of Michigan.

A-72