491. *Natural Resources and Modern Society*

Spring, Summer. 3(3-0) Juniors. Interdepartmental with the Resource Development Department and Natural Resources.

A survey of the social and economic significance of natural resources in modern industrial and urban society. Current problems of natural resources management and use are examined in terms of the society in which they exist.

807. *Special Problems*

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

Advanced work in any of the following forestry specialties: administration biometrics, photogrammetry, dendrology, silviculture, management, economics, influences, ecology, genetics, arboriculture, hydrology, soils, recreation, physiology, policy, entomology, products harvesting, wood preservation, timber mechanics, wood conversion.

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.

960. *Simulation Models in Natural Resource Management*

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:

Cultural—301, 307, 404, 801, 901.
Economic—213, 309, 409, 412, 413, 435, 454, 806, 807, 809, 835, 906.
Field Techniques—415, 850.
Geographic Education—458, 858.
Historical—310, 810, 910.
Independent Research—400H, 411, 818, 899, 918, 999.
Medical—470, 870, 970.
Physical—206, 206L, 429, 430, 431, 432, 451, 834, 902.
Political—416, 808, 908.
Population—320, 836, 934.
Quantitative Methods—427, 428, 811.
Regional—204, 300, 405, 406, 407, 408, 418, 420, 421, 440, 441, 450, 460, 461, 462, 463, 464, 812, 912.
Theory and Philosophy—150, 425, 480, 825, 826, 827.
Urban—318, 402, 403, 805.
Visual Media and Techniques—222, 223, 324, 424, 426.

150. *Geography of Selected Current Problems*

Fall. 2(2-0)

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 biotic resources, in their genetics, distributional and functional interrelationships.

206L. *Physical Geography Laboratory*

Fall, Winter, Spring. 1(0-2) 206 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 distribution 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(1-6)

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*

(401.) Fall, Winter, Spring, Summer. 4(3-0) 204.

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

307. *Geography of Environmental Quality*

(419.) Spring. 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.

320. *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(2-4) Sophomores.

Use of aerial photographs in the identification and interpretation of physical and cultural features of the terrestrial environment. Includes principles of photogrammetry.

341. Contemporary Problems of South Asia

For course description, see **Interdisciplinary Courses.**

384. Contemporary Problems of Japan

For course description, see Interdisciplinary Courses.

390. Survey of Subsaharan Africa

For course description, see **Interdisciplinary Courses.**

391. Survey of Subsaharan Africa

For course description, see **Interdisciplinary Courses.**

400H. Honors Work

Fall, Winter, Spring. 1 to 16 credits. Approval of department.

402. The Geography of the City

Fall. 4(3-0).

Spatial theories, concepts, and designs of internal urban economic, social, and political structures.

403. The American City and Its Region

Winter. 4(3-0).

The regional system of cities in terms of size, spacing, and functional relationships.

404. Advanced Cultural Geography

Spring. 4(3-0) 301 or approval of department.

Geographical analysis of selected aspects of human culture.

405. Geography of South America

Fall, Spring. 4(3-0) 204 or approval of department.

Regional geography of South America excluding countries bordering the Caribbean Sea; and the interpretation of present cultural-physical patterns.

406. Geography of Middle America

Winter. 4(3-0) 204 or approval of department.

Description and interpretation of the physical and cultural environment of Mexico, Central America, West Indies, and northern South America.

407. Geography of Michigan

Spring, Summer. 4(3-0) 204 or approval of department.

Selected aspects of the geography of Michigan, including the physical environment and cultural and economic considerations.

408. Geography of Canada

Spring. 4(3-0) 204 or approval of department.

Analysis of the cultural, economic, and physical regions of Canada and the role played by Canada in world affairs.

409. Geography of Transportation

(308.) Fall. 4(3-0).

Analysis of spatial principles of transportation, including factors of route, location, theories of interaction, and the role of transport in space-economy.

411. Problems in Geography

Fall, Winter, Spring, Summer. 1 to 6 credits. Approval of department.

Research on specialized geographic problems.

412. Geography of Agriculture

(312.) 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.

420. 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) 420 or approval of department.

Analysis of selected countries and regions of Subsaharan Africa.

424. Advanced Remote Sensing Techniques

Spring. 4(2-4) 324 or approval of department.

Geographic interpretation of records obtained from remote sensors including conventional, infrared, and radar imagery. Introduction to stero-plotting devices.

425. Development of Geographic Thought

Winter, Spring. 4(3-0) Approval of department.

Evolution, theory and methodology of geographic science.

426. Advanced Cartography

Spring. 4(1-6) 223; Juniors.

Development of skills in selection of cartographic source materials and in map construction.

427. Quantitative Methods in Geographic Research

Fall, Spring. 4(3-0) Approval of department.

Introduction to role of selected quantitative techniques used in the theory of geographic distributions and the analysis and classification of regional data.

428. Computer Techniques in Geography

Spring. 3(3-0) 427 or STT 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

(305.) Winter. 4(3-0) 206, 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) 206, GLG 201 or approval of department.

Treatment of selected aspects relating to surface configuration.

432. Biogeography

Spring. 4(3-0) 206 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. Plaimetric Cartography

Spring. 4(2-4) 324, 426 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) 204 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) 206 or approval of department.

A systematic treatment of climatological processes and their geographic implications.

454. Geography of Water

Fall. 4(3-0) 206 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.

476. *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.

801. *Seminar in Cultural Geography*
Fall. 3(3-0) Approval of department.

Theory, methodology, and techniques in cultural geography.

805. *Seminar in Urban Geography*
(804.) Spring. 3(3-0) Approval of department.

Selected research topics on the geography of the city.

806. *Seminar in Agricultural Geography*
Spring. 3(3-0) Approval of department, 412.

Research problems on selected topics of agricultural geography.

807. *Seminar in Manufacturing Geography*
Spring. 3(3-0) Approval of department, 413.

Research problems on selected topics of industrial location.

808. *Seminar in Political Geography*
Spring. 3(3-0) Approval of department.

Spatial analysis of selected political phenomena.

809. *Seminar in Transportation Geography*
Winter. 3(3-0) Approval of department, 409.

Selected research topics.

810. *Seminar in Historical Geography*
Winter. 3(3-0) Approval of department.

Approaches in research in historical geography.

811. *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.

812. *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.

818. *Readings in Geography*
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 rcedits. 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*
(816.) 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, Summer. Variable credit. Approval of department.

901. *Problems in Cultural Geography*
Fall, Winter, Spring. 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, 416.

Special research problems.

910. *Problems in Historical Geography*
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 6 credits. Approval of department.

Special research problems in historical geography.

912. *Independent Study in Regional Geography*
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 15 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.

970. *Problems in Medical Geography*

Fall, Winter, Spring. Variable credit. May re-enroll for a maximum of 6 credits. Approval of department.

Selected research topics in medical geography.

999. *Research*

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

GEOLOGY GLG

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(0-3) 200 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 environments. Conservation and interaction of energy and matter through time. Laboratory stresses interpretation of process 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, hydrologic, chemical, geological properties; and environmental quality of the oceans. Man-sea interactions are emphasized including resource utilization and pollution.

221. *Minerals, Rocks and Fossils*

(326.) Spring 3(2-3) Not open to majors.

Description, occurrence and identification of minerals, rocks, fossils, and additional features of especial significance to general science teachers and other earth science interest groups.

271. *Geophysics and the Earth*

Spring. 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 exploring for mineral 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.

295. *Introductory Earth Chemistry*

Winter. 3(3-0) 200 or 201 or 306, or approval of department.

Qualitative description of processes affecting distribution of elements in rocks, soils, waters, the atmosphere, and meteorites. Age of the earth. Origin of the elements. Geochemical methods to study the evolution of the mantle, crust, atmosphere and oceans.

302. *Vertebrate Life of the Past*

Fall. 3(3-0) One course in a physical or biological science for Juniors. Interdepartmental with the Zoology Department.

Fossil vertebrates from fish to man.

303. *Introductory Geomorphology*

Winter. 3(3-0) 200 or 201 or 306.

Descriptive course treating the geological origin and development of important surface features including special consideration of Pleistocene landforms of the Great Lakes region.

303L. *Laboratory—Introductory Geomorphology*

Winter. 1(0-2) 303 or concurrently.

Methods of map interpretation and use of aerial photographs in geomorphology. Supplemental field trip to study the geology of pertinent landforms.

304. *Geology of Michigan*

Fall. 3(3-0) 200 or 201 and/or 202; or approval of department.

A historical accounting of the physical, historical and economic geology of Michigan and its environs; a course designed for students seeking an overall picture of the rather unique Michigan geological environment.

306. *Engineering Geology*

Fall. 3(3-2) Credit will be given for only one of the following: 200, 201, 306. Sophomore Engineering students.

Fundamental principles of geology as applied to civil engineering practice. Minerals and rocks, aerial photographs, topographic and areal geologic maps and geologic cross sections studied in laboratory. Source of geologic literature and maps.

307. *Geology Central Appalachians*

Winter. 1(0-2) 200, or 201, or 202, or concurrently.

General geology of the Central Appalachians. A preparatory course for 308. Field excursions—Central Appalachians during spring vacation.

308. *Field Excursion--Central Appalachians*

Spring. 2 or 3 credits. 307.

Training in stratigraphic, sedimentological, paleontologic, and structural principles as applied to field methods.

321. *Mineralogy*

(421.) Fall. 5(4-4) One term of chemistry.

Introduction to crystal systems and forms exhibited by minerals, followed by study of composition, occurrence, classification, and identification of nonmetallic minerals.

322. *Mineralogy*

(422.) Winter. 4(3-4) 321.

Selective qualitative analysis of minerals by blow pipe and other methods.

335. *Fossil Plants, Their History and Paleoecology*

Winter. 3(3-0) One course in geology or botany or biology or approval of department. Interdepartmental with the Botany and Plant Pathology Department.

History of plants through geologic time; their form and evolution; how and where found, identified and reconstructed; their use in determining ancient geographic patterns, paleoenvironments, paleoclimates and community structure. Field trip.

344. *Field Geology—Summer Camp*

Summer. 9 credits. 202, 363. Trigonometry; GLG 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 textural relationships in igneous and metamorphic rocks.

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

363. *Lithology*

(323, 423.) Spring. 4(3-4) 321.

Processes that form igneous, metamorphic and and igneous rocks, origin, distribution, variation and occurrence of rock. Study of rock properties in the field, in 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(3-2) 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.