303L. Laboratory—Introductory Geomorphology
Spring. 1(0-2) 303 concurrently.
Methods of map interpretation and use of aerial photographs in geomorphology. Supplemental field trip to study the geology of pertinent landforms.

306. Engineering Geology
Fall. 3(2-2) 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 aerial geologic maps and geologic cross sections studied in laboratory. Source of geologic literature and maps.

326. Minerals, Rocks, and Fossils
Spring, Summer. 3(2-2) Not open to majors.
Description, occurrence, and identification of minerals, rocks, fossils, and additional features of special significance to general science teachers and other earth science interest groups.

344. Field Geology—Summer Camp
Summer. 9 credits. 202, 203, 433. Trigonometry, GLG 421, 434, and 451 recommended.
Methods and techniques of geological surveying and mapping. Field interpretation of geologic 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 survey, aerial photos 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.

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

411. Ground Water Geology
Winter. 3(2-2) 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(2-2) 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.

421. Mineralogy
Fall. 3(2-2) 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.

422. Geophysical Methods
Winter. 4(3-4) 421.
Application to mining, petroleum, and engineering problems.
475. Geophysics
Spring. 3(3-0) MTH 112; PHY 230.
General aspects of geophysics. Topics chosen from the following: earth's origin, age determinations, earthquakes, seismology, volcanism, seamount, mountain building, figure of earth, earth's interior, and terrestrial magnetism and electricity.

476. Geophysical Laboratory Investigations
Fall, Winter, Spring. Variable credit. May re-enroll for a maximum of 9 credits. Approval of department.
Independent laboratory research emphasizing geophysical model studies, instrumentation, and physical properties of earth materials.

477. Geophysical Field Studies
Fall, Winter, Spring. Variable credit. May re-enroll for a maximum of 9 credits. Approval of department.
Independent geophysical field studies and techniques.

482. Economic Geology—Principles
Spring. 3(3-0) 422.
Formation of mineral deposits except petroleum. Mineral economics, mining law, and mining methods discussed briefly. Writing of geological reports of important districts.

483. Petroleum Geology
Winter. 3(3-2) Approval of department.
Fundamental principles of the origin, migration and accumulation of petroleum. Exploration techniques to include well drilling, electric and radioactivity well logging, surface and subsurface exploration methods, seismic surveys, land leasing and oil field development. Laboratory study of well log plotting and subsurface mapping technique.

484. Applied Petroleum Geology
Spring. 3(1-4) 495.
Microscopic examination of well cuttings, practice in the use of electric and radioactivity logs, exploration for petroleum in selected areas by subsurface logging techniques, economics of petroleum exploration.

492. Sedimentology I
Fall. 3(2-3) 461 or approval of department.
Grain and aggregate properties of sediments; relationships of these properties to processes in the environment of deposition and to the pre-depositional and post-depositional history.

493. Sedimentology II
Winter. 3(2-3) 496.
Quantitative evaluation of sediment properties; sedimentary structures; regional analysis of sediment variation.

495. Geochemistry I
Fall. 3(3-0) 201, 492; CEM 153.
Qualitative and quantitative study of the element distribution in rocks, soils, oceans, and continental waters; geochemical processes governing their distribution; and introduction to phase equilibria and crystal chemistry.

496. Geochemistry II
Winter. 3(3-0) 495.
Continuation of 495. Application of thermodynamics to geochemical problems. Study of isotope ratios and their application to geochemical problems in the earth's crust.

800. Special Problems
Fall, Winter, Spring, Summer. Variable credit. Approval of department.
Special problems in hydrogeology, geomorphology and glacial geology, mineralogy and crystallography, petrology, paleontology, structural geology, and petrofabrics, stratigraphy, aerogeology, geophysics, economic geology, petroleum geology, sedimentation, and geochemistry.

810. Seminar
Fall, Winter, Spring. 1 credit. May re-enroll for a maximum of 3 credits. Selected topics relating to current research in geology.

811. Physical Oceanography
Spring. 3(3-2) Approval of department.
Study of geomorphic, sedimentary, and geohistorical and geophysical aspects of oceans, including marine hydrodynamics, ocean waves, tides, currents, methods, and instruments of ocean study.

812. Principles of Geomorphology
Fall. 3(3-2) 201, 303, or approval of department.
Landforms and processes involved in their origin and development. Emphasis on fundamental concepts as they relate to directional and constructive stresses on earth materials. Introduction to quantitative laboratory and field methods.

814. Field Palynology
Summer. 3(3-2) 491.
Mineral structures studied by X-ray diffraction methods.

830. Paleobotany
Fall. 4(3-4) Approval of department. Interdepartmental with and administered by the Botany and Plant Pathology Department.
Survey of fossil plants: their preservation, occurrence, geology, paleogeography, paleoecology, evolutionary history, classification and representative types. One weekend field trip to fossil plant locality.

833. Metamorphic Petrology
Winter. 3(2-4) Approval of department.
Classification and morphology of metamorphic rocks. Study of certain algae, pro­ zooans, similar organisms of uncertain affinity and dissociated fragments of larger organisms.

838. Advanced Paleobotany
Winter. 3(2-4) Approval of department. Interdepartmental with and administered by the Botany and Plant Pathology Department.
Morphology, anatomy, phylogenetic relationship and classification of fossil plants. Microscopic analysis of tissues and organs prepared by thin section, transfers, peels, polished and etched surfaces, and macerations.

842. Pre-Cambrian Geology
Spring. 3(2-4) 434, 434.
Pre-Cambrian of North America with special reference to stratigraphic correlation and economic development.

843. Paleozoic Stratigraphy
Winter. 4(5-0) 434, 492.
Classification, distribution, paleo­ geograph, paleontological, interrelationship, and structural setting of stratigraphic units within the Paleozoic systems. Laboratory work involves construction of correlation charts, structure and restored sections, paleogeologica, paleophysiographic, and lithofacies maps, and study of certain key fossils.

851. Petrofabrics
Winter. of odd-numbered years. 3(2-4) 462.
The use of the petrographic microscope and universal stage in determining rock fabrics; the interpretation of these fabrics in terms of regional structural geology.

852. Advanced Structural Geology
Winter of even-numbered years. 3(2-4) 431, MTH 214.
Mathematics and physics applied to problems in structural geology.

857. Petrology—Metamorphic
Spring. 3(3-4) 462.
Origin and classification of metamorphic rocks. Study includes thin section investigation of the metamorphic textures and mineral associations and the physical-chemical principles involved in their development.

864. Advanced Sedimentology
Spring. 3(2-4) May re-enroll for a maximum of 12 credits. 493, approval of department.
Selected topics of current sedimentological interest.

870. Geophysics Seminar
Fall, Winter, Spring. Variable credit. May re-enroll for a maximum of 12 credits. Approval of department.
Selected topics in geophysics.

871. Advanced Geophysical Laboratory
Fall, Winter, Spring. Variable credit. May re-enroll for a maximum of 9 credits. Approval of department.
Laboratory research on selected geophysical problems.

872. Field Seismology
Fall. 4(2-4) 474.
Theory and technique of field seismic exploration methods. An associated geophysical survey will be conducted and a report prepared.

873. Fundamentals of Seismology I
Winter. 3(3-0) MTH 215 or concurrently, PHY 259 or concurrently.
Theory and application of seismic wave propagation in earth materials.
GERMAN AND RUSSIAN

College of Arts and Letters

Students who have had high school work in the foreign language in which they wish to continue their studies must take a placement examination in that language. Placement in the appropriate course is determined by the results of this examination. University credit is not given for courses waived by performance on the placement examination. Also, registration for credit is not permitted in courses for which the equivalent high school credit has been earned. In general, one year of high school language study is considered equivalent to one term of university study. This means that a student with two years of high school credit in a language should place no lower than 103 on the placement test. If he places higher, for example, in 201, 103 is waived without credit. However, if his placement examination indicates that he is not qualified for 103, he must enroll in the appropriate lower course without credit.

To receive credit in first year foreign language courses, all three terms, 101, 102, 103, must be completed satisfactorily.

German and Russian Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Times</th>
<th>Credits</th>
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<tbody>
<tr>
<td>299. Special Projects</td>
<td>Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 18 credits. Approval of department.</td>
<td>Work in areas outside regular course offerings.</td>
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<tr>
<td>303. Folklore</td>
<td>Spring. (3-0)</td>
<td>Folk heritage of peoples as revealed in their legends, superstitions, ballads, folksongs, heroic tales, sayings, customs, and beliefs. Historical development of traditional lore as a reflection of social attitudes and the source for national mythologies.</td>
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<tr>
<td>417. Scandinavian Contributions to Literary Tradition</td>
<td>(C L 418.) Fall. (3-0)</td>
<td>Approval of department. Development and influence of the ideas, forms and motifs of the Scandinavian literatures in the literatures of the world.</td>
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<tr>
<td>418. Scandinavian Contributions to Literary Tradition</td>
<td>(C L 418.) Winter. (3-0)</td>
<td>Approval of department.</td>
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<tr>
<td>419. Scandinavian Contributions to Literary Tradition</td>
<td>(G L 418.) Spring. (3-0)</td>
<td>Approval of department.</td>
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<tr>
<td>499. Special Projects</td>
<td>Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 18 credits. Approval of department.</td>
<td>Work in areas outside regular course offerings.</td>
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