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Modern geography is concerned with the spatial analysis of physical, economic, social, and political phenomena; the spatial aspects of human behavior; and the interaction of man and his environment. To develop concepts, models, and theories which facilitate the study of location, human behavior, and man-environment relations from a geographic perspective, the Department of Geography offers a coordinated program of courses at the beginning, intermediate, and advanced levels, with research seminars for qualified graduate students. In addition, courses have been developed to provide students with the technical skills necessary for geographic analysis of human activities and the environments in which they take place. Special attention is given to the utilization of theory and the construction of models in analyzing urban and regional problems.

An undergraduate major in geography should be regarded as part of a liberal arts program, and not necessarily as preparation for a specific profession. However, opportunities for undergraduate majors in geography do exist in various branches of government and in business. There is a demand for persons capable of dealing with resource management, production potentials, economic development, market area analysis, and other problems related to the distribution of physical, economic, social, and political phenomena in the world as a whole or in major parts of it. There is also a growing demand for young people concerned with man's perception of, and his subsequent interactions with his total environment. Courses in geography are commonly required of students who are preparing to enter the teaching profession at the elementary and secondary school levels, and of those who desire to work in urban and regional planning.

Graduate training, culminating in the M.A. and Ph.D. degrees, is essential for those who expect to make a career of college teaching. Also, many of the governmental and business positions in geography are available only to those who have completed graduate work in the discipline. The Association of American Geographers publishes monthly a bulletin entitled *Jobs in Geography*. Copies of this bulletin may be reviewed in the departmental office.

Social Science Core Requirement

The social science core requirement may be fulfilled by the completion of 44:1 and 44:2, which may be taken in either order or simultaneously.

Undergraduate Requirements

Students majoring in geography may qualify for either the B.S. or B.A. degree. Course requirements for either of these degrees are:

Twenty-eight semester hours in geography including:

44:1	Geography and Human Activities	4 s.h.
44:2	Natural Environment and Man	4 s.h.
44:50	Undergraduate Seminar for Geography Majors	2 s.h.

The remaining eighteen semester hours may be elected from any of the 100-level courses offered by the department.

22S:43 Introduction to Statistical Methods
or its equivalent 3 s.h.

For the B.S. degree only, students must also complete:
22M:25 Calculus or its equivalent 4 s.h.

For the general requirements for the B.A. degree see *College of Liberal Arts*. Students who desire professional careers in geography are urged to complete the requirements for the B.S. degree; and if a career in foreign service is contemplated, at least three years of the appropriate foreign language should be completed.

Graduate Study

Reflecting modern developments in geographic research and instruction, the faculty of the Department of Geography is interested in offering courses and supervising research in the following major areas, especially as they

are related to urban and regional systems analysis; behavioral theory, location theory, and the interaction of environment and human behavior.

Human behavior will be studied in its spatial context. Examples of problems to be included are the development of models of environmental perception; the construction of models for the analysis of political, social, and economic behavior; and public policy implications of behavior patterns as related to problems of spatial organization.

In the development of location theory, special attention will be given to the testing of existing theory; the incorporation of behavioral theory and postulates in locational analysis; policy implications of locational theory; and the application of theory to the location of public services and the problems of underdeveloped areas.

In studying the interaction of man and his environment special attention will be given to the evolution and analysis of the natural resource base; regional problems in resource use; human ecology; population distribution and growth; environmental hazards and stress; environmental pollution and control; landform processes; and landscape systems.

Admission to department. In addition to the general rules and regulations set forth in the *Manual of Rules and Regulations of the Graduate College*, the Department of Geography will not accept any student whose undergraduate grade-point average is less than 2.5 (4.0 basis), unless special consideration of a particular student is merited. A student's Graduate Record Examination Aptitude Test should total 1100. All new students must be recommended by at least two instructors familiar with their undergraduate work, or in the case of students admitted with advanced graduate credit, by two instructors familiar with their graduate work.

Students whose undergraduate grade-point average is between 2.5 and 2.75 will be admitted on a conditional basis only. They must achieve a grade-point average of 2.75 or better on their first 12 hours of graduate work as approved by the department in order to remain as graduate students.

No student will be considered for a graduate assistantship or fellowship whose grade-point average during his junior and senior years was less than B (3.0 on a four-point scale), or if admitted with advanced graduate credit, whose graduate grade-point average does not equal B. Students receiving financial assistance must maintain a B average for continued support.

Requirements for Master of Arts degree. Programs for candidates for the M.A. and Ph.D. degrees in geography are established separately for each student. Candidates who plan to terminate their graduate work with the Master of Arts degree are required to complete a minimum of 38 semester hours of graduate work, including 44:108, 44:201, and 44:202. Candidates for the terminal Master of Arts degree must pass a general examination consisting of written and/or oral parts.

Students who plan to continue their graduate work toward the Ph.D. should complete all the requirements listed above for the terminal candidates, 44:208, and two research seminars offered by two different faculty members. It is expected that the four core courses, 44:108, 44:201, 44:202, and 44:208, will be completed during their first year in residence. Students entering for the first time will be permitted to satisfy the above requirements by successfully completing written examinations covering the content of 44:201, 202, 108, and 208 to be given during the first week of the semester in which they first register. The remainder of the M.A. program may be composed of 100- or 200-level courses, courses in disciplines closely related to the student's objectives and interests, courses in mathematics to complete the tool requirements for the doctorate, research seminars, or research-level courses in which the student may earn credit by working as a research apprentice to a faculty member. Not more than 6 semester hours can be earned, however, as a research apprentice.

Candidates for the Master of Arts degree who plan to study for the doctorate must pass the general examination consisting of written and/or oral parts no later than the beginning of their fourth semester in residence.

All students are required to register for 44:350 each semester while in residence. During the academic year,

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one semester hour of credit will be awarded each semester on an S-U basis for 44:350 Staff Seminar.

Requirements for the Ph.D. degree. Doctoral candidates are required to complete all the requirements for the M.A. degree, including the general examination; the research tool requirements outlined below; and a qualifying paper based on his research, to be presented to Staff Seminar. All doctoral candidates are expected to have supervised experiences as classroom instructors and research assistants before being awarded the Ph.D. degree.

Research tool requirements for the Ph.D. candidates are of two kinds. One of these is the course 44:208 Advanced Quantitative Methods; the other may be satisfied by passing one of the following: Mathematics 22M:27 Introduction to Linear Algebra, 22M:100 Differential Equations, Statistics 22S:164 Introduction to Probability, or 22S:120 Probability and Statistics; or by demonstrating competence in a foreign language.

To become a candidate for the Ph.D. a student is required to pass a comprehensive examination consisting of written and oral parts, in which he must demonstrate analytical proficiency with respect to a major area of specialization (approved in advance by the faculty) and a general knowledge of the discipline including both content and methodology. Upon passing the comprehensive examination, the doctoral candidate must prepare a research design to be presented before Staff Seminar. After the design has been approved by the faculty, the candidate will conduct the necessary research and analysis, and present his findings in a dissertation which he must defend in a final oral examination.

STAFF

Professor: Clyde F. Kohn.
Professor Emeritus: Harold H. McCarty.
Associate Professors: Kenneth J. Dueker, Frank E. Horton, James B. Lindberg, David R. Reynolds, Gerard Rushton, Neil E. Salisbury.
Assistant Professors: James Gardner, John Mercer, Michael McNulty.

COURSE DESCRIPTIONS

Primarily for Undergraduates

44:1 Geography and Human Activities 4 s.h.
Geographical analysis of human behavior. Application of principles to contemporary social, economic, and political problems. Open to freshmen.

44:2 Natural Environment and Man 4 s.h.
Geographic patterns of world's natural resources: climate, water, landforms, soils, vegetation, and minerals. Man's role in defining the nature of the resource base. Regional problems in resource use, environmental pollution, and natural hazards. Open to freshmen.

44:50 Undergraduate Seminar for Geography Majors 2 s.h.
Nature of geography as a professional field; geographic methods of analysis; research in geography. Students will prepare a research paper. Required of all undergraduate majors in their senior year. Open only to undergraduate majors in geography.

For Undergraduates and Graduates

44:100 Readings in Geography cr.arr.
Prerequisite, consent of department.

44:101 Introduction to Weather and Climate 3 s.h.
Spatial distribution of weather elements, wind circulation, air masses, storms, and general climatic conditions of the world, including air pollution and climatic change. Laboratory work in the study of weather maps and climatic data.

44:106 Geography in the School Curriculum 3 s.h.
New concepts and content of geography essential to effec-

tive educational programs. Methods of geographic inquiry. Examination of media effective in teaching geography.

44:108 Quantitative Methods 3 s.h.
Mathematical and statistical techniques in current research in geography.

44:111 Geographic Analysis of Social Behavior 3 s.h.
Spatial distribution of population, including density, composition, growth, and migration. Spatial organization of social systems, including religion, education, welfare, and medical services; introduction to diffusion and migration models.

44:115 Political Behavior and Urban Spatial Structure 3 s.h.
The political organization of urban areas and the problems and impact of reform. The spatial aspects of voting behavior and the relationship with urban spatial structure. Locational decisions and conflict situations in metropolitan areas.

44:116 Political Ecology 3 s.h.
Analysis of temporal and spatial variations in the relationships between political behavior and social, political, and geographical space at different levels of the society and the polity.

44:120 Natural Hazards 3 s.h.
Definition, classification, and world distribution of natural hazards. Examination of causes and consequences through study of the spatial and temporal covariation of selected physical, social, and cultural elements in a series of case studies.

44:122 Natural Habitats of the United States 3 s.h.
The nature, pattern, and interdependence of elements of the natural resource base.

44:130 Location of Economic Activities 3 s.h.
Principles of areal organization and their application to the location patterns of agriculture, manufacturing, transportation, and services.

44:132 Industrial Location 3 s.h.
Theory of manufacturing location, and its application to different industries and types of economy, with investigations of selected case studies.

44:135 Internal Spatial Structure of Urban Areas 3 s.h.
Models of urban growth and urban forms. Spatial patterns of selected activities. Processes that generate these patterns, and current problems.

44:136 Geographic Analysis of Inner City Areas 3 s.h.
Residential segregation of minority groups. The spatial structure of "ghetto" areas. Environmental quality of inner city neighborhoods. Spatial aspects of problems of economic and social stress.

44:138 Area Analysis 3 s.h.
Theory of regions, methods of analysis, geographic systems, interpretation and preparation of reports for various types of area studies.

44:141 United States and Canada 3 s.h.
Methods of analysis of regional economic development, with specific application to the regions of these nations.

44:161 Africa 3 s.h.
Spatial aspects of development in Africa. Geographical interpretations of selected problems confronting the African nations.

For Graduates Only

44:201 Geographical Analysis I 3 s.h.
Past and present philosophies of geography in light of philosophical developments in science in general. Critical review of the research literature of the past.

44:202 Geographical Analysis II 3 s.h.

A critical examination and evaluation of recent methodological and theoretical developments in geography. Prerequisite, 44:201.

44:208 Advanced Quantitative Methods 3 s.h.

Mathematical and statistical techniques in current geographical research with emphasis upon the employment of the computer and the development of research designs. Prerequisites, a knowledge of computer programming and 44:108, its equivalent, or consent of the instructor.

44:211 Spatial Organization of Social Processes and Behavior 3 s.h.

Spatial aspects of diffusion processes as applied to the spread of culture traits and ideas; diffusion of innovations; human migrations; growth and spread of rural and urban settlements; changes in the spatial characteristics of social phenomena in urban places.

44:215 Locational Analysis of Political Behavior 3 s.h.

Locational basis of political and quasipolitical behavior at the individual and various systems levels. Spatial dimensions of electoral behavior; aspects of political modernization; urban public policy making. Prerequisites, 44:202, 44:208, or consent of the instructor.

44:216 Behavioral Analysis in Geography 3 s.h.

Various behavioral model-building strategies pertaining to spatial behavior and spatial structure with an emphasis on environmental perception approaches. Prerequisite, 44:108, 44:202, or consent of the instructor.

44:219 Fluvial Morphology and Landscape Systems 3 s.h.

The role of running water and mass movement in shaping the form of the land. Systems of description and explanation of landscape form.

44:220 Elements of Natural Hazards 3 s.h.

Physical and human elements that combine to produce natural hazards with emphasis on the frequency and distribution of the natural processes. Man as catalyst, man as controller, cultural and social adjustments, and prediction.

44:230 Locational Analysis of Economic Behavior 3 s.h.

Development and testing of normative and descriptive models for the location patterns of economic phenomena. Prerequisites, 44:202, 44:208, or consent of the instructor.

44:235 Spatial Structure of Residential Areas 3 s.h.

Behavioral processes as related to spatial patterns of residential areas. The process of residential site selection and the attributes of residential areas. Linkages between residential areas and other elements of urban area. Prerequisites, 44:108, 44:202, or consent of instructor.

44:236 Travel Behavior in Urban Areas 3 s.h.

Theoretical and conceptual basis of urban travel behavior. Evaluation of current models of travel behavior, interaction between intraurban spatial structure and travel behavior, new research strategies and experimental behavioral models helpful in gaining insight into urban travel behavior processes. Prerequisites, 44:108, 44:202, or consent of the instructor.

44:237 Macro Models of Urban Growth and Development 3 s.h.

The development of urban models which attempt to predict urban growth and activity location patterns. The theoretical and operational nature of these models, analytical methods employed, and new concepts in urban macro-modeling strategies. Prerequisites, 44:202, 44:208, or consent of instructor.

44:238 Spatial Implications of Public Policies 3 s.h.

The impact of public policies at national, regional, and local levels on the location of a range of physical and

social phenomena, with emphasis on international comparisons. Urban renewal, regional growth policies, transportation systems, and conservation policies. Prerequisites, 44:108, 44:202, or consent of instructor.

44:239 Spatial Aspects of Urban Renewal 3 s.h.

Programs of public urban renewal in American cities from different perspectives. Siting of projects, economics of urban renewal, social impact and problems of relocation, political decisions, evaluation of the programs, and legislative frameworks of urban renewal with consideration of programs in selected countries. Prerequisites, 44:108, 44:202, or consent of the instructor.

44:261 Geographic Perspectives on Development 3 s.h.

Theoretical and empirical studies of the development process with special emphasis on spatial implications of socio-economic changes attendant upon development. Prerequisites, 44:108, 44:202, or consent of instructor.

44:280 Field Techniques in Physical Geography 3 s.h.

Sampling procedures, and the collection of field data in physical geography, together with the laboratory analysis of data.

44:306 Research Seminar: The Teaching of Geography cr.arr.**44:308 Research Seminar: Quantitative Methods, Computer Methods, and Modeling cr.arr.****44:311 Research Seminar: Geographic Analysis of Social Behavior cr.arr.****44:315 Research Seminar: Locational Analysis of Political Behavior cr.arr.****44:316 Research Seminar: Space Perception cr.arr.****44:318 Research Seminar: Pleistocene cr.arr.****44:319 Research Seminar: Physical Geography cr.arr.****44:320 Research Seminar: Natural Hazards and Problems cr.arr.****44:330 Research Seminar: Geographic Analysis of Economic Behavior cr.arr.****44:331 Research Seminar: Location Theory cr.arr.****44:335 Research Seminar: Urban Housing, Redevelopment, and Renewal cr.arr.****44:336 Research Seminar: Urban Travel Behavior cr.arr.****44:337 Research Seminar: Urban Macro Models cr.arr.****44:338 Research Seminar: Urban Transportation Issues 3 s.h.**

Same as Urban and Regional Planning 102:226.

44:339 Research Seminar: Urban Information Systems 3 s.h.

Same as Urban and Regional Planning 102:227.

44:350 Staff Seminar cr.arr.**44:380 Field Seminar cr.arr.****44:406 Research: The Teaching of Geography cr.arr.****44:408 Research: Quantitative Methods, Computer Methods, and Modeling cr.arr.**

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44:419 Research: Physical Geography	cr.arr.
44:440 Research: Environment and Behavior	cr.arr.
44:441 Research: Locational Analysis	cr.arr.
44:442 Research: Models of Spatial Behavior	cr.arr.
44:450 Thesis	cr.arr.

GEOLOGY

Chairman of Department, Brian F. Glenister
Office, 106 Calvin Hall

The Department of Geology instructs students in the fundamental principles of geology for purposes of general education and prepares specialists for careers in academic, public, and industrial work. Courses are offered for the general liberal arts students, for those pursuing curricula on the undergraduate and graduate levels, for those planning to teach in secondary schools, and for those planning to enter professional work.

Two undergraduate degrees are offered, the Bachelor of Arts in geology and the Bachelor of Science in earth science.

Because geologists need a thorough background in related sciences, the Master of Science degree is highly desirable for any geological vocation. Therefore, successful majors in geology are required to take 30 semester hours or more of graduate courses leading to the Master of Science degree.

The Bachelor of Science degree is designed to prepare teachers of earth science in the secondary schools and junior colleges. To complete the requirements necessary for Iowa secondary teaching certification in this field, the student must take the equivalent of the one-year program leading to the Master of Arts in Teaching degree at this University.

Undergraduate Requirements

With the current explosion of knowledge and the breakdown of traditional disciplinary boundaries, professional geologists need a broad background in mathematics, natural science, and social science, as well as competence in geology. These two goals can no longer be realized in the traditional four-year undergraduate program. Therefore, practically all students wishing to become professional geologists should earn a master's degree. The B.A. program is designed primarily to prepare students for graduate study. Employers of geologists are primarily interviewing advanced-degree candidates.

Required courses in the B.A. program fall into four categories:

1. *Liberal arts.* The student enters the course sequences in foreign language, rhetoric, and mathematics at a level appropriate to his background and performance on entrance examinations. Geology majors should elect French, German, or Russian to satisfy the language requirement. It is suggested that the social science requirements be fulfilled by approved courses selected from economics, geography, and anthropology. Maximum semester hours in this first category will be 62; most students will require less.

2. *Supporting sciences.* Mathematics, chemistry, physics, and biology courses are required by the geology department to give the student basic understanding of principles and techniques valuable to advanced geological investigations. At least seven courses in the supporting sciences are required. In this category the geology department will allow considerable latitude consistent with the student's high school science background and his career objectives. We recognize three principal options:

A. Most students will take two semesters of chemistry, physics, calculus, and one or two semesters of biological science to obtain minimum breadth of exposure.

B. Some students will be able to demonstrate the need for additional coursework in one area in place of work in another area. For example, a student definitely committed to paleontology might take two additional semesters of biology rather than calculus; a potential geophysicist might elect additional mathematics and physics in place of biology. In all cases the seven-semester-courses requirement will be applied.

C. A few students may find it advantageous to substitute specialized or esoteric courses for one of the more traditional sciences. Courses in engineering, statistics, computer science, astronomy, or archaeology are examples. Again, the seven-semester-courses requirement will be in force.

3. *Geology courses.* Thirty semester hours are required to acquaint the undergraduate student with the fundamentals and broad scope of geological subjects. Courses required of all geology majors are:

12:3	Physical Geology	2 s.h.
12:4	Historical Geology	2 s.h.
12:5	Physical Geology Laboratory	1 s.h.
12:41	Mineralogy	3 s.h.
12:112	Geologic Field Methods	1 s.h.
12:191	Structural Geology	4 s.h.
12:121	Principles of Paleontology	3 s.h.
12:113	Summer Field Course	6 s.h.
12:198	Senior Seminar	1 s.h.

Recommended electives to complete the 30-semester-hour minimum are stratigraphy, geomorphology, sedimentology, economic geology, and petrology. 11:23 and 11:24 Earth History and Resources may be substituted for 12:3 and 12:4 Physical and Historical Geology.

4. *Research.* Many students in the junior or senior year will be ready to pursue some aspect of original investigation for credit. Each case will be considered individually. The student may assist a faculty member or graduate student with a current research project, or he may initiate a small-scale project involving a combination of field, laboratory, and library investigation. Such work will be in addition to the required 30 semester hours of geology courses.

The requirements for a Bachelor of Science in earth science are the same as those for the B.A. except that the language and mathematics requirements are reduced to one year each, with substitution of an appropriate number of semester hours in astronomy, geography, and psychology.

Graduate Requirements

Ample facilities are available within the department for those who wish to earn the M.S. and Ph.D. degrees. Students who plan to take graduate work in geology should have completed, as undergraduates, geology courses equivalent to those required of U of I undergraduate geology majors, as well as the supporting courses in chemistry, physics, zoology, and mathematics. Deficiencies in background may be remedied in the initial graduate years. Applicants must meet the general requirements for admission to the Graduate College.

The Graduate College requires a minimum of 30 semester hours of graduate work for the M.S. degree; at least 24 semester hours must be completed in residence. For the Ph.D. degree at least three academic years must be completed altogether, during which the candidate earns a minimum of 24 semester hours of graduate credit in residence.

All graduate students in geology are required to perform either teaching, research, or other services for the department each calendar year as part of the degree programs.

Master of Science Degree with Thesis

1. Candidates should, as undergraduates and graduates, complete courses in mineralogy, optical mineralogy, stratigraphy, geomorphology field geology and field course, structural geology, paleontology, economic geology, sedimentology, and petrology. Any completed course in the subject may be accepted as satisfying the requirement.

2. Graduate students are expected to complete the equivalent supporting courses required of department undergraduates (one year of college chemistry, physics, and zoology, plus mathematics through calculus). Some

appropriate additional work in one area may be used to satisfy the requirement in another area. The same courses cannot be used under requirements 2 and 3.

3. Candidates require competence in a scientific language (French, German, or Russian) or in an appropriate tool, such as statistics. Competence is demonstrated by examination or by satisfactory completion of a one-year sequence in a scientific language course or comparable tool area, either as part of the degree program or in previous training.

4. For purposes of computing graduate credit, not more than 8 semester hours of thesis and research may be included in the 30 semester hours minimum required for the degree program.

5. To qualify for thesis defense or final oral examination, the candidate must have at least a 2.75 G.P.A. on graduate courses taken at the U of I that are being offered toward a degree.

Master of Science Degree without Thesis

The Master of Science degree without thesis is designed for students with extensive geological background and experience.

1. A candidate selected for this program must have had approximately three months' experience under the supervision of a professional geologist, or the equivalent, in some phase of geologic activity. If possible, the candidate should receive permission from the staff, before beginning that activity, to use the experience toward his degree. The candidate must submit a written report describing his activities and the geologic principles involved, the value of the work, and its broader applications and implications. The work will not be accepted toward the Master of Science degree requirements until the report has been approved. No college credit will be given for this work.

2. The Master of Science degree without thesis requires a minimum of 38 semester hours of coursework at the graduate level, of which 8 semester hours must be taken in other departments of the University. All other departmental requirements will apply under this option.

3. In addition, the staff may require the degree candidate without thesis to prepare a formal scientific report dealing with an appropriate subject or project. Credit may be received for this report.

Doctor of Philosophy Degree

Within broad limits, courses selected should reflect the individual needs, interests, and talents of the aspirant. The minimum requirements are:

1. Doctoral candidates must satisfy the departmental course requirements for the master's degree in geology. Where appropriate, additional work in one area of study may be approved as satisfying requirements in another area.

2. An appropriate graduate course in another discipline is to be included in the Ph.D. program of courses.

3. Graduate coursework totaling 24 semester hours exclusive of dissertation research credits, and in addition to courses used for the master's degree.

4. Competence in two scientific languages, or in a combination of one language and one tool. Proficiency in one language may substitute for competence in two areas. Competence is demonstrated by examination or by satisfactory completion of a one-year sequence in a scientific language course or comparable tool area, either as part of the degree program or in previous training. Proficiency is demonstrated by satisfactory completion of a two-year sequence in a scientific language course, either as part of the degree program or in previous training.

5. The doctoral thesis should be an original and independent contribution to the general body of geological knowledge. In addition to its original research contribution, it should present a synthesis of all pertinent knowledge and related matters and the candidate's evaluations, speculations, and generalizations about his topic.

STAFF

Professors: William M. Furnish, Brian F. Glenister, Richard A. Hoppin, Sherwood D. Tuttle.
Adjunct Professor: Samuel J. Tuthill.
Professors Emeriti: Joseph J. Runner, Allen C. Tester, Arthur C. Trowbridge.
Associate Professors: Gilbert Klapper, George R. McCormick, Holmes A. Semken, Jr., Keene Swett.

Assistant Professors: Richard G. Baker, John H. Carman, Lon D. Drake, Jeffrey T. Schabillon.
Research Associate: Harrell L. Strimple.
Laboratory Manager: Roger C. Rudesill.
Librarian: Vera Bacon.
Technician: Kenneth H. Kern.

COURSE DESCRIPTIONS

Primarily for Undergraduates

12:3 *Principles of Geology (Physical)* 2 s.h.

Geology for students who wish to become acquainted with the philosophical aspects of geology. Study of rocks and minerals, weathering, erosion, rock deformation, mountain building, earthquakes, and interior of the earth. Open to all except those who have had previous college courses in geology or earth science.

12:4 *Principles of Geology (Historical)* 2 s.h.

Continuation of 12:3, but may be taken as an independent unit. Earth history through 5 billion years, with emphasis on the last 600 million years. Evolution of selected animal and plant groups and a survey of geologically important fossils. Not open to students who have had a college course in historical geology.

12:5 *Physical Geology Laboratory* 1 or 2 s.h.

Not open to those who have had or are taking 11:23 Earth History and Resources. May be taken concurrently with 12:3. Prerequisite, college geology.

12:6 *Historical Geology Laboratory* 1 s.h.

Not open to those who have had or are taking 11:24 Earth History and Resources. May be taken concurrently with 12:4. Prerequisite, college geology.

12:9 *Geology of Iowa* 2 s.h.

Survey of geologic features in the state. For students who have had a previous course in geology. Lectures and field trips.

12:10 *Honors Thesis in Geology* cr.arr.

Prerequisite, consent of the department.

12:11 *Methods of Geological Instruction* 1 s.h.

Instructional methods utilized in elementary geology. Literature review of presentation techniques, and instructional duties in an elementary laboratory. Prerequisite, consent of instructor.

12:17 *Terrain Analysis* 3 s.h.

Techniques of topographic map and aerial photo reading. Prerequisite, sophomore standing.

12:41 *Mineralogy* 3 s.h.

Introductory study of minerals, stressing description, identification, and classification. Prerequisite, an introductory geology course.

12:52 *Elementary Petrology and Geochemistry* 3 s.h.

A lecture, laboratory, and discussion course dealing with the principles of geochemistry, hand specimen petrography, and the principles of petrology for igneous, sedimentary, and metamorphic rocks. Prerequisite, 12:42.

For Undergraduates and Graduates

12:103 *Physical Geology* 2 or 3 s.h. Summer session.

12:104 *Historical Geology* 2 or 3 s.h. Summer session.

12:106 *Geologic Map and Aerial Photo Interpretation* 3 s.h. Prerequisite, consent of instructor.

12:108 *Geology of North America* 3 s.h. Offered in 1971-72 and in alternate years. Prerequisite, earth science or college geology.