REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN GEOLOGY
COLLEGE OF GEOSCIENCES
THE UNIVERSITY OF OKLAHOMA

For Students Entering the Oklahoma State System for Higher Education: **Summer 2000 through Spring 2001**	**Minimum Credit Hours and Grade Averages Required** Total Credit Hours . . . . 125 **Grade Point Averages:** Minimum in OU Coursework . . . . 2.00 Minimum in Major Coursework . . . . 2.00 Overall 2.00	Environmental Geology Option **1914D** Bachelor of Science in Geology

Year	FIRST SEMESTER	Hours	SECOND SEMESTER	Hours
FRESHMAN	**ENGL 1113**, Principles of Composition (Core I) **MATH 1823**, Calculus & Analytic Geometry I (Core I) **CHEM 1315**, General Chemistry (Core II) **GEOL 1114**, Physical Geology for Science and Engr. Majors	3 3 5 4	**ENGL 1213**, Principles of English Composition (Core I) **MATH 2423**, Calculus & Analytic Geometry II **CHEM 1415**, General Chemistry (Continued) **GEOL 1124**, Earth History	3 3 5 4
	TOTAL CREDIT HOURS	**15**	**TOTAL CREDIT HOURS**	**15**
SOPHOMORE	**MATH 2433**, Calculus & Analytic Geometry III **HIST 1483** or **1493**, U.S. (Core IV) **GEOL 2224**, Introduction to Mineral Sciences [1]Free Elective [2]Artistic Forms Elective (Core IV)	3 3 4 3 3	**MATH 2443**, Calculus & Analytic Geometry IV **PHYS 2514**, General Physics for Engineering and Science Majors (Core II) **GEOL 3223**, Igneous and Metamorphic Petrology **GEOL 3233**, Sedimentary Petrology and Sedimentology	3 4 3 3
	TOTAL CREDIT HOURS	**16**	**TOTAL CREDIT HOURS**	**13**
JUNIOR	**PHYS 2524**, General Physics for Engr. & Science Majors **C S 1313**, Computer Programming **GEOL 3114**, Structural Geology **GEOL 3513**, Fundamental of Invertebrate Paleontology	4 3 4 3	**P SC 1113**, American Federal Government (Core III) [1]Free Elective [3]Science Requirement [2]Social Sciences Elective (Core III) [2]Western Civilization & Culture Elective (Core IV)	3 3 3 3 3
	TOTAL CREDIT HOURS	**14**	**TOTAL CREDIT HOURS**	**15**
SENIOR	**ENGL 3153**, Technical Writing **GEOL 4113**, Principles of Stratigraphy Geology/Geophysics Elective [3]Science Requirement [2]Non-Western Culture Elective (Core IV)	3 3 3 3 3	**GEOL 3123**, Introductory Field Geology **GPHY 3413**, Principles of Geophysics [1]Free Elective [1]Free Elective [3]Science Requirement	3 3 3 4 3
	TOTAL CREDIT HOURS	**15**	**TOTAL CREDIT HOURS**	**16**

SUMMER
GEOL 4136, Field Geology (Capstone)—6 CREDIT HOURS

To obtain a BS in Geology with an Environmental Geology option, a student must take the same coursework as that for a BS in Geology except for 12 hours of geology/geophysics and allied science electives which are more narrowly specified. The student must satisfy 6 hours of geology/geophysics and allied science elective requirements by taking GEOL 3154, Environmental Geology and GPHY 4633, Hydrogeology. The student must also satisfy 6 additional hours of allied science elective requirements chosen from an approved course list.
See reverse side for course listings.

[1] = Thirteen hours of faculty-adviser-approved electives. Foreign language courses taken to satisfy University-Wide Gen. Ed. requirements may be counted as lower-division free electives. However, in order to satisfy the college requirement of 48 hours of upper-division coursework, 12 hours of free electives and/or humanities/social/sciences must be taken as upper-division.
[2] = To be chosen from the University-Wide General Education Approved Course List. Three hours of General Education must be upper-division outside the major.
[3] = A minimum of 9 hours of faculty-adviser approved courses in geophysics, geography, meteorology, biological sciences, chemistry, computer science, math, physics, and/or engineering. Nine hours (6 must be upper-division) must include: one 3-hour geoscience elective outside of major (can be in geophysics), one 3-hour course taken outside the college, and one 3-hour geophysics or other science elective outside the major.
NOTE: No more than 48 hours may be taken in one department of the College.

University-Wide General Education Requirements (minimum 40 hours)

Courses designated as Core I, II, III or IV are part of the General Education curriculum. Students must complete a minimum of 40 hours of General Education courses, chosen from the approved list, including at least one upper-division Gen. Ed. course outside of the student's major. Courses graded S/U or P/NP will not apply.

Core I	**Symbolic and Oral Communication (9–19 hours, 3–5 courses)** •English Composition–6 hours, 2 courses •Mathematics–3 hours, 1 course •Foreign Language–0–10 hours, 2 courses in the same language, (can be met by successfully completing 2 years of the same foreign language in high school) •Other (courses such as communication, logic or public speaking)
Core II	**Natural Science (8 hours, 2 courses)** •Courses must be taken from different disciplines in the biological and/or physical sciences; one of which must include a laboratory.
Core III	**Social Science (6 hours, 2 courses)** •One course must be P SC 1113, "American Federal Government"
Core IV	**Humanities (12 hours, 4 courses)** •Understanding Artistic Forms–3 hours, 1 course •Western Civilization and Culture–6 hours, 2 courses, including HIST 1483 or HIST 1493 •Non-Western Cultures–3 hours, 1 course
Senior Capstone Experience (3 hours, 1 course)	

Required Courses for BS in Geology—Environmental Geology Option
•GEOL 3154, Environmental Geology must be taken to satisfy the BS in Geology 3 hour GEOL/GPHY elective.
•GEOL 4633, Hydrogeology will satisfy either the Geosciences (non-Geology) elective, the Geophysics, or other science elective requirement.

Science electives taken to satisfy the remaining 6 of the 12 hours of geology/geophysics and allied science electives must be chosen from the following list:		
•GPHY 4970, Environmental Geophysics •GEOG 4203, Geomorphology •GEOG 5253, Remote Sensing II •GEOL 4970, Environmental Geochemistry •CHEM 3012 & 3013, Organic Chemistry & Lab	•CHEM 3421 & 3234, Physical Chemistry & Lab •C E 3212 & 3234, Environ. Engineering I & II •ENGR 3223, Fluid Mechanics •MATH 3083, Computer Related Math	•MATH 3113, Intro. to Ordinary Differential Equations •MATH 3333, Linear Algebra I •MATH 3413, Physical Math I •MATH 4073 & 4083, Numerical Analysis I & II

COURSES IN CHEMISTRY (CHEM)

3012 Organic Chemistry Laboratory. Prerequisite: concurrent enrollment in 3013 or permission of the department. (F)

3013 Organic Chemistry. Prerequisite: 1415 or 1425, concurrent enrollment in 3012 or permission of the department. Structure and reaction of both aliphatic and aromatic compounds. Reaction mechanism and modern structural theory. (F)

†G3421 Physical Chemistry Laboratory. Prerequisite: chemistry majors must concurrently enroll in 3423. Physiochemical measurements and calculations. (F, Sp, Su)

†G3423 Physical Chemistry I. Prerequisite: 1425, Physics 2524, Math 2423 or concurrent enrollment; chemistry majors must concurrently enroll in 3421. States of matter, chemical thermodynamics, equilibria, etc. (F, Sp, Su)

COURSES IN CIVIL ENGINEERING (C E)

3212 Environmental Engineering I. Prerequisite: Engineering 3223. Fluid flow, water distribution/wastewater collection design, surface water hydrology, storm sewer design, ground water hydrology. (F)

3234 Environmental Engineering II. Prerequisite: 3212. Design of systems to control environmental quality including water and wastewater treatment, ground water quality management, air pollution, and solid/hazardous waste management. **Laboratory** (Sp)

COURSES IN COMPUTER SCIENCE (C S)

1313 Computer Programming. Prerequisite: Mathematics 1523 or equivalent. Introduction to the design and implementation of computer programs using procedural languages such as FORTRAN and C. Emphasis on problem solving and on scientific and engineering applications. (F, Sp)

COURSES IN ENGINEERING (ENGR)

3223 Fluid Mechanics. Prerequisite: 2213, Mathematics 2433; concurrent enrollment in 2113 and Mathematics 3113. Coverage of the fundamentals of fluid statics and dynamics. Formulation of the equation of fluid flow, i.e., Navier Stokes Equations, Eulers Equations, Bernoulli Equations, etc. and their application. Examples of ideal fluid flow and viscous fluid flow, such as flow in open and closed conduits. (F, Sp, Su)

COURSES IN GEOGRAPHY (GEOG)

G4203 Geomorphology. Prerequisite: 1114, or comparable work in earth sciences, junior standing. Development and modification of land-surface form by atmospheric, fluvial, glacial, mass-wasting, volcanic and tectonic agents. Emphasis is placed on spatial aspects of the interactions at the interfaces of land, air and water. (Irreg.)

G5253 Remote Sensing II. Prerequisite: 4933 or permission of instructor. Theory and techniques for computer processing of digital earth resources satellite imagery and incorporation into geographic information systems. (Sp)

COURSES IN GEOLOGY (GEOL)

1114 Physical Geology for Science and Engineering Majors. Prerequisite: equivalent knowledge of high school chemistry, algebra and trigonometry. Laboratory included. Plate tectonics, the makeup of continents and mountain building. Heat flow, magnetism, gravity, rock deformation, earthquakes and the earth's interior. Surface processes including weathering, erosion, transport and deposition. Landforms, rivers, groundwater, glaciers, ocean processes, and volcanoes. Minerals and rocks. Application of geology to land-use, groundwater, mineral and fossil fuel exploration. **Laboratory** (F, Sp)

1124 Earth History. Prerequisite: none; 1114 helpful but not required. Laboratory included; field trip. Physical history of the earth from its origin as a planet through the Great Ice age. Origin and growth of continents and ocean basins. Systematic survey of the history of continents with emphasis on North America: growth and leveling of mountain chains, rift valleys, transgressions and regressions of seas; continental fragmentation, assembly and relative motions. Plate tectonics, particularly as it relates to continent history. Climate and evolutionary changes through geologic time. Principles and methods used to interpret earth history and date rocks. Geologic time. Laboratory includes historical studies of specific regions; study of maps and fossils. **Laboratory** (F, Sp)

2224 Introduction to Mineral Sciences. Prerequisite: 1114 or permission; Chemistry 1415 or concurrent enrollment. Crystallography, crystal chemistry, optical properties and identification of minerals utilizing the petrographic microscope; an introduction to the rock-forming minerals and their relationships within igneous, metamorphic, and sedimentary rocks. **Laboratory** (F)

3114 Structural Geology. Prerequisite: 2224, Physics 2524 or concurrent enrollment; or permission. An introduction to the concepts of stress, strain, the mechanisms of rock deformation, the mechanics of folding and fracturing, and plate tectonics. A description of the structure of the major provinces of North America with a discussion of their origin. **Laboratory** (F)

3123 Introductory Field Geology. Prerequisite: 3114 or concurrent enrollment; or permission. Laboratory included. Field trips; students will be charged transportation costs. Techniques of geologic fieldwork. Use of Brunton compass, alidade and plane table and topographic maps. Field examination of common geologic situations. Field exercises. **Laboratory** (Sp)

†G3154 Environmental Geology. Prerequisite: college algebra and permission of instructor; completion of one college level science course recommended. Designed for students who are wanting to know to relationship between earth materials and environmental issues. Topics include minerals, rocks, depositional environments, porosity, permeability, water occurrence and chemistry, petroleum, natural gas, tar sands, oil shales, land subsidence, and earthquakes. Laboratory includes the study of minerals, rocks, maps, and well cuttings. **Laboratory**

3223 Igneous and Metamorphic Petrology. Prerequisite: 2224 or permission. Laboratory included. Field trip; students will be charged transportation costs. Generation, emplacement and crystallization of magma; phase chemistry; principles of igneous rock classification; the relationship of magma types to geologic setting. Principles of metamorphic petrology; phase chemistry

and metamorphic reactions; concepts of metamorphic grade, P-T regimes and relationships to geologic environments; concepts of protoliths and provenance. Laboratory study of the textures, structures and mineral assemblages of igneous and metamorphic rocks utilizing hand specimens and thin sections. **Laboratory** (Sp)

3233 Sedimentary Petrology and Sedimentology. Prerequisite: 2224 or permission. Laboratory included. Field trip; students will be charged transportation costs. Origin, evolution and interpretation of sedimentary rocks with an emphasis on terrigenous systems; interpretation of mineralogy, textures and structures of terrigenous clastic and carbonate rocks in hand specimen and thin section. **Laboratory** (Sp)

3513 Fundamentals of Invertebrate Paleontology. Prerequisite: 1124 or permission. Laboratory included. Field trip; students will be charged transportation costs. A systematic approach to the animal invertebrate phyla, emphasizing fossil forms as they occur in the geologic record. Paleontologic principles and methods with emphasis on evolutionary paleontology, paleoecology and stratigraphic paleontology. Brief treatments of biogeochemistry and paleobiogeography. **Laboratory** (F)

G4113 Depositional Systems and Stratigraphy. Prerequisite: 3114 or permission. Basic stratigraphic principles as well as reconstruction of ancient depositional systems. The controls on deposition of stratigraphic sequences, completeness of the rock record and sequence stratigraphy. Field trip; students will be charged transportation costs. **Laboratory** (Sp)

†G4133 Fundamentals of Petroleum Geology. Prerequisite: 1124, junior or senior standing. Includes history of North American oil industry; drilling, completing and producing an oil well; methods used in petroleum exploration; origin, evolution, migration and trapping of hydrocarbons; application of well-logging to subsurface studies; oil producing basins of North America and Canada. Practical problems and mapping exercises included. **Laboratory** (F)

4136 Field Geology. Prerequisite: 3123; senior standing or permission. A six-week summer course held at the Oklahoma Geology Camp at Canon City, Colorado. Applications of field techniques, including use of aerial photographs and construction of geological maps, to the recognition and interpretation of geologic phenomena. (Su)

G4633 Hydrogeology. Prerequisite: Mathematics 2443, Physics 2524, senior standing in geology, or permission of instructor. Darcy's law, Hubbert's fluid potential, equations of groundwater flow. Physical properties of geologic materials and fluids. Free convection, compaction- and gravity-driven flow. Role of fluids in geologic phenomena, including mineralization, metamorphism, hydrocarbon migration, sedimentary diagenesis, faulting and earthquakes, paleomagnetism. Application of geologic and geophysical techniques to fluid flow problems.

COURSES IN GEOPHYSICS (GPHY)

3413 Principles of Geophysics. Prerequisite: Mathematics 2423; Physics 2524; or equivalent or permission. A survey of current methods of geophysical measurements and their interpretations. The earth's gravity, magnetic, seismic, mechanical and thermal properties will be discussed. (Sp)

G4114 Environmental and Geotechnical Geophysics I. Prerequisite: Mathematics 2434, Physics 2524, or permission of instructor. Part of a two-semester sequence covering the major geophysical tools for environmental and geotechnical problems. Focus on characterizing shallow geologic stratigraphy and structure. This geologic information is applied to geotechnical and environmental concerns such as choice of landfill site, the containment of fluid pollutants in the subsurface, and geotechnical assessment. Techniques to be covered include seismic refraction, seismic reflection, and gravity. (F)

G4124 Environmental and Geotechnical Geophysics II. Prerequisite: Mathematics 2434, Physics 2524, or permission of instructor. Part of a two-semester sequence covering the major geophysical tools for environmental and geotechnical problems. Consider techniques used to locate and identify isolated targets such as buried tanks, drums, pits, and trenches. Techniques to be covered include magnetics, resistivity, electromagnetic induction, and ground penetrating radar. (Sp)

G4874 Seismic Exploration. Prerequisite: Physics 2524; Mathematics 2434 or concurrent enrollment. Lectures and laboratory/problem sessions covering theory and applications of reflection and refraction seismic exploration methods. Emphasis is on the common-depth-point reflection method. (F)

COURSES IN MATHEMATICS (MATH)

1823 Calculus and Analytic Geometry I. Prerequisite: 1523 at OU, or satisfactory score on the placement test, or satisfactory score on the ACT/SAT. Topics covered include equations of straight lines; conic sections; functions, limits and continuity; differentiation; maximum-minimum theory and curve sketching. A student may not receive credit for this course and 1743. (F, Sp, Su)

2423 Calculus and Analytic Geometry II. Prerequisite: 1823. Integration and its applications; the calculus of transcendental functions; techniques of integration; and the introduction to differential equations. A student may not receive credit for this course and 2123. (F, Sp, Su)

2433 Calculus and Analytic Geometry III. Prerequisite: 2423. Polar coordinates, parametric equations, sequences, infinite series, vector analysis. (F, Sp, Su)

2443 Calculus and Analytic Geometry IV. Prerequisite: 2433. Vector calculus; functions of several variables; partial derivatives; gradients, extreme values and differentials of multivariate functions; multiple integrals; line and surface integrals. (F, Sp, Su)

†G3113 Introduction to Ordinary Differential Equations. Prerequisite: 2443 or concurrent enrollment. Duplicates two hours of 3413. First order ordinary differential equations, linear differential equations with constant coefficients, Laplace transformations, power-series solutions of differential equations, Bessel functions. (F, Sp, Su)

†G3333 Linear Algebra I. Prerequisite: 2433 or permission of instructor. Systems of linear equations, determinants, finite dimensional vector spaces, linear transformations and matrices, characteristic values and vectors. (F, Sp, Su)

†G3413 Physical Mathematics I. Prerequisite: 2443 or concurrent enrollment. Complex numbers and functions. Fourier series, solution methods for ordinary differential equations and partial differential equations, Laplace transforms, series solutions, Legendre's equation. Duplicates two hours of 3113. (F)

G4073 Numerical Analysis I. Prerequisite: 3113 or 3413. Solution of linear and nonlinear equations, approximation of functions, numerical integration and differentiation, introduction to analysis of convergence and errors, pitfalls in automatic computation, one-step methods in the solutions of ordinary differential equations. (F)

G4083 Numerical Analysis II. Prerequisite: 3113 or 3413; 4073 or Electrical Engineering 4713; 3333 or 4373 or Biostatistics and Epidemiology 5563. Matrix inversion and related topics; numerical solution of ordinary differential equations, partial differential equations, integral equations and functional equations; numerical solution of eigenvalue problems and applications of functional analysis. (Alt. Sp)

COURSES IN PHYSICS (PHYS)

2514 General Physics for Engineering and Science Majors. Prerequisite: Mathematics 1823. Not open to students with credit in 1205. Vectors, kinematics and dynamics of particles, work and energy systems of particles, rotational kinematics and dynamics, oscillations, gravitation, fluid mechanics, waves. (F, Sp, Su)

2524 General Physics for Engineering and Science Majors. Prerequisite: 2514 and Mathematics 2423. Not open to students with credit in 1215. Temperature, heat, thermodynamics, electricity, magnetism, optics. (F, Sp, Su)