



GEOLOGICAL SCIENCES

Associate Professor Peter E. Sablock, Chairperson

Professors: James L. Cullen, Garland A. Gray, Jr., Lindley S. Hanson

Associate Professor: Jeanette M. Sablock

PROGRAMS OFFERED

Bachelor of Science – Geological Sciences

Concentrations

Earth Science
Environmental Geology

Minors

Earth Science
Geological Sciences
Secondary Education

Programs in Geological Sciences

The Department of Geological Sciences offers a Bachelor of Science – Geological Sciences, a Bachelor of Science – Geological Science with either an Environmental Geology or an Earth Science Concentration, and minors in geology, earth science, and earth science education. In addition, the department offers an individualized Study Program leading to a Bachelor of Science-Geological Science (please see the Department Chairperson for further details about this option).

The B.S. – Geological Sciences is designed to best prepare students for careers in general geology and for graduate school in geology. The concentration in Environmental Geology is designed to prepare students for a career in Environmental Geology or related environmental fields (such as hydrogeology or pollution control, coastal zone management, watershed management, environmental mapping, water resources, land evaluation and site assessment and subsurface remote sensing), or to prepare students for graduate work in the environmental sciences.

The department is equipped with state of the art geological and environmental equipment to include Ground Penetrating Radar, Seismographs, Electrical Resistivity Meters, Geomagnetic Sensors, water control probes (long term deployable), X-ray Diffraction and Scanning Electron Microscopes as well as rock saws, petrologic microscopes and laser surveying equipment. This equipment is supported by post processing software on departmental computers.

The concentration in Earth Science provides a program with a broader-based science curriculum which will be more effective in areas less specialized than those described above. For example, those students who wish to minor in secondary school teaching in Earth Science are effectively served by the concentration in Earth Science. The Earth Science concentration is also more adaptable in general for transfer students who may be interested in Geological Sciences, but have difficulty fitting course work taken at other institutions into the highly structured B.S. – Geological Sciences.

The specific requirements for the three programs including the major and support courses, are listed on the corresponding flow sheets.

In all three programs, two of the support courses and the non-geology additional science electives may be used to satisfy the Division II distribution.

For a Bachelor of Science – Geological Sciences a minimum of 126 semester credits hours is required. The 18 credits hours of additional science/math electives must include at least 6 credits hours in Geology electives.

For a Bachelor of Science – Geological Sciences with an Environmental Geology Concentration a minimum of 126 semester credits hours is required. Note that CHE 130 and CHE 131 should be taken as the laboratory science distribution sequence.

For a Bachelor of Science – Geological Sciences with an Earth Science Concentration a minimum of 126 semester credits hours is required. Note that GLS 100 and GGR 100P should be taken as the laboratory science distribution sequence. Courses in Cartography or a Secondary Education minor can be substituted for some or all of the 12 credits hours of science/math electives.

Earth Science Association

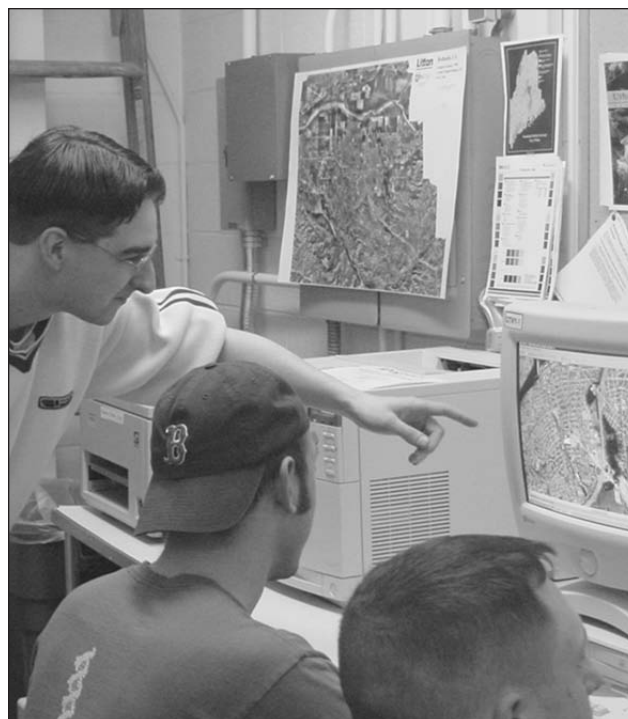
The Earth Science Association is a student organization open to any Salem State student interested in the earth sciences. The Association sponsors field trips, lectures, and social events in cooperation with the Department of Geological Sciences.

Honors Program

Candidates for departmental honors in the Geological Sciences shall fulfill the All College honors requirements as well as departmental requirements and specifications.

The honors program is open only to seniors with at least a 3.0 GPA over-all. The student must undertake an Honors Project which will consist of 3 to 6 hours of Directed Studies in the Geological Sciences in lieu of 3 to 6 hours of electives. The Project will consist of field, laboratory, or library-oriented research supervised by a designated faculty member in the Department of Geological Sciences. The project must be completed by the end of the third week in November for the Fall semester or the end of the second week in April for the Spring Semester.

The student will take an oral examination before the Department Honors Committee based in part upon their research project and in part upon their general background of Geological Sciences course work. The examination will be given once each semester, the first week in December and the last week in April.





MINORS

For a Geological Sciences Minor. 15-18 semester credits hours in Geology courses are required, as approved by the Geological Sciences Chairperson.

For an Earth Science Minor. 15-18 semester credits hours in Natural Sciences are required, as approved by the Geological Sciences Chairperson.

For a Secondary Education Minor in Earth Sciences the student must complete the courses required for a major in Geological Sciences with Earth Science Concentration previously described.

In addition, minors in Secondary Education must complete the courses listed below (subject to revision by the Education Department). Students planning to pursue the secondary education minor should see page 258 in the Education Department section of the catalog for requirements for admission to the teacher licensure program. Candidates for teacher licensure in Massachusetts must now also take and pass the Massachusetts Educators Certification Test.

1. American Government. See Education Department listing 3 credits
2. Education Component (27 Credits)
 - EDU 251 The Secondary School-History & Thought 3 credits
 - EDU 252 The Contemporary High School 3 credits
 - EDU 337S Secondary School Curriculum Materials and Methodology in Teaching Science 3 credits
 - EDU 255A Instructional Technology for the Secondary School 3 credits
 - EDU 256 The Secondary School: Urban-Suburban-Legal Issues 3 credits
 - EDU 497 Practicum in Student Teaching in Secondary Education (9-12), Earth Sciences 12 credits
3. Support Course.
 - PSY 252 Adolescent Psychology 3 credits

Measurement and Evaluation standard will be met through the Student Teaching Seminars.





Geological Sciences
Salem State College
Advisor: _____

Name: _____
Date admitted into Major: _____
Transfer credits: _____

**BACHELOR OF SCIENCE
GEOLOGICAL SCIENCES**

CORE REQUIREMENTS

Competency-Based Skills

- @ Basic College Math
- @ Reading Comprehension
- @ Computer Literacy

@	ENG	101	Composition I	3	_____
@	ENG	102	Composition II	3	_____
@	SPC	101	(Speech)	3	_____
@	SFL	194	Health and Wellness	3	_____

Physical Education Activities (1 cr. total)

@	SFL	_____	_____	_____	_____
@	SFL	_____	_____	_____	_____

Distribution Sequences (20 credits)

_____	_____	(Literature I)	3	_____	
_____	_____	(Literature II)	3	_____	
*	CHE	130	General Chemistry I	4	_____
*	CHE	131	General Chemistry II	4	_____
@	HIS	101	History of World Civilization I	3	_____
@	HIS	_____	(History II)	3	_____

Distribution Electives (18 credits)

Among the distribution electives, the student must earn at least 3 but no more than 9 additional semester hours in each of the three divisions.

Humanities (Division I)

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Science/Mathematics (Division II)

*	MAT	220	Calculus I	4	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Social Sciences (Division III)

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

(Note: Courses allowable as distribution electives are marked 'D' in the College Catalog or indicated by appropriate footnotes.)

COURSES IN MAJOR (41 credits)

GLS	100	Physical Geology w/Lab	4	_____
GLS	201	Historical Geology	4	_____
GLS	210	Geomorphology	4	_____
GLS	221	Mineralogy	4	_____
GLS	322	Petrology	4	_____
GLS	330	Paleontology	4	_____
GLS	334	Sedimentation & Stratigraphy	4	_____
GLS	341	Structural Geology & Tectonics	4	_____
GLS	351	Economic Geology	3	_____
GLS	470	Field Geology	6	_____

(Summer between Junior and Senior Years)

SUPPORT COURSES (11-12 credits)

BIO	132	Introduction to Cells	4	_____
MAT	221	Calculus II		_____
		OR		
MAT	247	Statistics	3-4	_____
PHS	211	General Physics I	4	_____

***** ADDITIONAL SCIENCE ELECTIVES (17 credits)**

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

FREE ELECTIVES (5-11 credits)

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

- @ Requirements so marked should be completed within the first 53 credits of study (i.e., before Junior status). Exceptions will be made for transfer students.
 - * These are **required** support courses which may also be used to satisfy the indicated Distribution requirements. A student may choose to fulfill Distribution requirements with courses other than the ones listed, but these listed courses must still be taken.
 - ** GLS 353 can substitute for GLS 351.
 - *** Six credits from the non-geology additional science electives may be used to satisfy Division II Electives. The additional science electives will include any courses in natural science or math, of which at least 6 credit hours must be in geology.
- Note: If a course is used to satisfy two or more requirements (for example, a support course and a distribution elective), the credits are counted in only one place. Using a course to satisfy more than one requirement does **not** reduce the credit total required for graduation.

Total credits for graduation: 126

Effective: 9/04



Geological Sciences
Salem State College
Advisor: _____

Name: _____
Date admitted into Major: _____
Transfer credits: _____

BACHELOR OF SCIENCE
GEOLOGICAL SCIENCES
EARTH SCIENCE CONCENTRATION

CORE REQUIREMENTS

Competency-Based Skills

- @ Basic College Math
@ Reading Comprehension
@ Computer Literacy

Table with 4 columns: Prefix, Course Number, Course Name, Credits. Includes ENG 101, ENG 102, SPC 101, SFL 194.

Physical Education Activities (1 cr. total)

Table with 4 columns: Prefix, Course Number, Course Name, Credits. Includes SFL courses.

Distribution Sequences (20 credits)

Table with 4 columns: Prefix, Course Number, Course Name, Credits. Includes Literature I/II, GLS 100, GLS 100P, HIS 101.

Distribution Electives (18 credits)

Among the distribution electives, the student must earn at least 3 but no more than 9 additional semester hours in each of the three divisions.

Humanities (Division I)

Table with 4 columns: Prefix, Course Number, Course Name, Credits. Blank rows for student input.

Science/Mathematics (Division II)

Table with 4 columns: Prefix, Course Number, Course Name, Credits. Blank rows for student input.

Social Sciences (Division III)

Table with 4 columns: Prefix, Course Number, Course Name, Credits. Blank rows for student input.

(Note: Courses allowable as distribution electives are marked 'D' in the College Catalog or indicated by appropriate footnotes.)

COURSES IN MAJOR (38-39 credits)

Table with 4 columns: Course Number, Course Name, Credits, and a blank column for student input. Includes GLS 201, 330, 334, 221, 210, 322, 212, GGR 252P, BIO 322, PHS 207, GGR 350P, BIO 208, GLS 120, 470.

** SUPPORT COURSES (16-20 CREDITS)

Table with 4 columns: Course Number, Course Name, Credits, and a blank column for student input. Includes MAT, CHE, BIO, PHS courses.

Additional Cartography or Math/Science Electives, or courses towards an Education Minor: (12 credits)

Table with 4 columns: Prefix, Course Number, Course Name, Credits. Blank rows for student input.

FREE ELECTIVES (5-15 credits)

Table with 4 columns: Prefix, Course Number, Course Name, Credits. Blank rows for student input.

@ Requirements so marked should be completed within the first 53 credits of study...
* These are required support courses...
** Any two of the support courses may be used to satisfy the Division II Distribution Electives.
Note: If a course is used to satisfy two or more requirements...



Geological Sciences
Salem State College
Advisor: _____

Name: _____
Date admitted into Major: _____
Transfer credits: _____

**BACHELOR OF SCIENCE
GEOLOGICAL SCIENCES
ENVIRONMENTAL GEOLOGY
CONCENTRATION**

CORE REQUIREMENTS

Competency-Based Skills

- @☐ Basic College Math
- @☐ Reading Comprehension
- @☐ Computer Literacy

@	ENG	101	Composition I	3	_____
@	ENG	102	Composition II	3	_____
@	SPC	101	(Speech)	3	_____
@	SFL	194	Health and Wellness	3	_____

Physical Education Activities (1 cr. total)

@	SFL	_____	_____	_____	_____
@	SFL	_____	_____	_____	_____

Distribution Sequences (20 credits)

_____	_____	(Literature I)	3	_____	
_____	_____	(Literature II)	3	_____	
*	CHE	130	General Chemistry I	4	_____
*	CHE	131	General Chemistry II	4	_____
@	HIS	101	History of World Civilization I	3	_____
@	HIS	_____	(History II)	3	_____

Distribution Electives (18 credits)

Among the distribution electives, the student must earn at least 3 but no more than 9 additional semester hours in each of the three divisions.

Humanities (Division I)

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Science/Mathematics (Division II)

**	_____	_____	Science/Math Elective	3	_____
**	_____	_____	Science/Math Elective	3	_____
**	_____	_____	Science/Math Elective	3	_____

Social Sciences (Division III)

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

(Note: Courses allowable as distribution electives are marked 'D' in the College Catalog or indicated by appropriate footnotes.)

COURSES IN MAJOR (43-44 credits)

GLS	100	Physical Geology w/Lab	4	_____
GLS	201	Historical Geology	4	_____
GLS	210	Geomorphology	4	_____
GLS	214	Coastal Geology	4	_____
GLS	334	Sedimentation & Stratigraphy	4	_____
GLS	341	Structural Geology & Tectonics	4	_____
GLS	353	Geochemistry	3	_____
GLS	356	Hydrology	4	_____
GLS	357	Environmental Geology	3	_____
GLS	215	Glacial and Quaternary Geology	3	_____
		OR		
GLS	380	Applied Environmental Geophysics		
GLS	470	Field Geology or other departmentally approved field course	6	_____

SUPPORT COURSES (19 credits)

CHE	212	Organic Chemistry I	4	_____
CHE	213	Organic Chemistry II	4	_____
		OR		
PHS	211	General Physics I	4	_____
MAT	220	Calculus I	3	_____
MAT	247	Statistics	3	_____
BIO	132	Introduction to Cells	4	_____

**** SCIENCE/MATH ELECTIVES (6 credits)**

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

(Note: 9 additional credits of Science/Math electives are required. These are listed under Distribution Electives, Division II.)

FREE ELECTIVES (7-8 credits)

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

- @ Requirements so marked should be completed within the first 53 credits of study (i.e., before Junior status). Exceptions will be made for transfer students.
 - * These are **required** support courses which may also be used to satisfy the indicated Distribution requirements. A student may choose to fulfill Distribution requirements with courses other than the ones listed, but these listed courses must still be taken.
 - ** Recommended Science/Math electives include: BIO 208, BIO 320, CHE 321, PHS 211, PHS 212, GLS 343, GLS 345, GLS 380, CSC 148, GGR 250P, and GGR 352.
- Note: If a course is used to satisfy two or more requirements (for example, a support course and a distribution elective), the credits are counted in only one place. Using a course to satisfy more than one requirement does **not** reduce the credit total required for graduation.

Total credits for graduation: 126

Effective: 9/04



COURSE DESCRIPTIONS

GEOLOGICAL SCIENCES

GLS 100 Physical Geology with Lab 4 credits DII
Survey of earth materials and earth systems including minerals and rocks, volcanoes, streams, glaciers, oceans, plate tectonics and general principles. Three lecture hours and one two-hour laboratory per week. (Satisfies Distribution Division II requirements of laboratory science sequence with GGR 100P, GLS 101 or GLS 201).

GLS 101 Field Studies in Earth Science (Fall) 4 credits DII
A continuation of GLS 100 using outdoor New England as a laboratory to explore our physical environment. Weekly field trips and field exercises to investigate earth processes are scheduled during class and laboratory hours and are a fundamental part of the course. One three day, long-weekend field trip required. Three lecture hours and three field laboratory hours per week scheduled; however the mix may vary. Offered in the fall only. Satisfies laboratory science sequence with GLS 100.
Prerequisite: GLS 100 or permission of Department Chairperson.

GLS 105 Geologic Information Analysis 2 credits
Computer based methods of capturing, analyzing, and interpreting geologic data. Particular emphasis will be given to the selection and use of appropriate analytical techniques for various types of geologic data. Two lecture hours per week with a computer laboratory component.
Prerequisite: GLS 100; CSC 100 or permission of Department Chairperson.

GLS 110 Geology of National Parks 3 credits DII
Features, processes and geologic history of the National Parks. Presented primarily for non-geology majors. Three lecture hours per week.

GLS 115 Geology of the Solar System 3 credits DII
A study of the origin and evolution of our solar system. An examination of the composition, surficial and internal geologic processes that shape and form the planets and satellites. Three lecture hours per week.

GLS 120 Our Geological Environment 3 credits DII
Discussion of present-day geological aspects of our environment and their impact on our daily life. Selected topics include: water resources, uses and pollution; geologic hazards such as floods, coastal erosion, and earthquakes; energy and mineral resources. Three lecture hours per week. Intended for students not majoring in Geological Sciences.

GLS 135 Earth Materials 3 credits DII
The ability to recognize, classify and interpret the origins of earth materials is a useful skill to those in many different fields including earth science, environmental science, botany, and science education. This course gives students the opportunity to acquire a working knowledge of the earth materials and resources we depend on such as minerals, sediments, petroleum products and coal. Three hours a week of integrated discussion and experiential learning.

GLS 160 The Earth's Surface 3 credits DII
A description of landscape features on the surface of the Earth and their origins. The underlying structures and processes which help streams, wind, glacial ice, and gravitational movement to create the Earth as we see it will be central to the course. Three lecture hours per week. The course is designed primarily for non-geology majors and cannot be taken in lieu of GLS 210.
Prerequisite: GLS 100, or permission of Department Chairperson.

GLS 201 Historical Geology 4 credits DII
Principles and techniques used to interpret the history of the earth. The origin and evolution of the earth, its atmosphere, oceans, plants and animals. In laboratory students are acquainted with the use of geologic maps and sections and fossils. Three lecture hours and three hours of laboratory per week. Satisfies Distribution Division II laboratory science sequence requirement with GLS 100.
Prerequisite: GLS 100, or permission of Department Chairperson.

GLS 208A Geologic Map Preparation and Interpretation 3 credits DII
Introduction to geologic map making and interpretation. This includes preparation and interpretation of topographic base maps and geologic maps from air photos and outcrop data. Special attention will be paid to the construction and interpretation of geologic cross sections. Occasional local field trips (may be during the school week or weekends) may be required. Not open to students who have received credits for GLS 208. Two lecture and two laboratory hours per week.
Prerequisites: GLS 100 or permission of Department Chairperson.

GLS 210 Geomorphology 4 credits DII
Description and interpretation of landforms, and the exogenic and endogenic processes that shape the Earth's surface. Three lecture hours and three hours of laboratory per week.
Prerequisite: GLS 100, or permission of Department Chairperson.

GLS 212 Submarine Geology 3 credits DII
Introduction to the geology and geophysics of the oceans emphasizing mechanisms and processes operating in the marine realm. A broad spectrum of marine geology subjects will be covered including the structure, geophysics, rocks, sediments, microfossils, stratigraphy, and history of the ocean basins and margins. Three lecture hours per week. Offered alternate years.
Prerequisite: GLS 100 or permission of Department Chairperson.

GLS 214 Coastal Geology 4 credits DII
An analysis of factors that govern the morphology of coasts and beaches. A field oriented course designed to introduce students to introductory techniques dealing with field mapping, research, data collection and analysis while focusing on coastal changes and processes. Students will also learn relevant computer skills. Additional topics will include factors governing coastal morphology, coastal hazards related to erosion, and the effect of human intervention along the coast. Three lecture hours and three hours of field work and research per week. Offered alternate years.
Prerequisite: GLS 201 or permission of Department Chairperson. Limited to 15 students.

GLS 215 Glacial and Quaternary Geology 3 credits
This course focuses on processes of glacial erosion and deposition and the glaciation of the Northeast. The distribution and character of glacial sediment so important to local hydrologic and coastal systems are studied in detail. Also included is an introduction to the geology of non-glaciated regions, such as the arid southwest. Three lecture hours per week and a weekend field trip. Offered alternate years.
Prerequisite: GLS 201 or permission of Department Chairperson. Limited to 15 students.

GLS 221 Mineralogy 4 credits DII
A study of the elements of crystallography, physical and chemical properties of minerals, their structures, occurrences, and the conditions under which they form. Laboratory includes study of crystal morphology and identification of minerals. Two lecture hours and two two-hour laboratories per week.
Prerequisite: GLS 100 or permission of Department Chairperson.

GLS 222 Gemology 3 credits DII
The properties, identification, origin, evaluation, and preparation of gem stones and gem materials. Three lecture hours per week. Offered alternate years.
Prerequisite: GLS 100 or permission of Department Chairperson.

GLS 235 Forensic Geology 4 credits DII
This course is intended for both geology and on-geology majors. It provides a useful and practical approach to the forensic value of earth materials. Students will learn both from lecture and from experiential activities about the ideas, methods, applications and handling of earth materials for forensic purposes. Guest lecturers will add another dimension to class work. Two two-hour sessions of integrated lecture and related activities.
Prerequisites: GLS 100 or GLS 135 or permission of the Department Chairperson.


GLS 322 Petrology 4 credits

Properties, occurrences, origin and classification of the common igneous, metamorphic and sedimentary rocks. Laboratory work includes examination of rocks in hand specimen and in thin section using the petrographic microscope. Two lecture hours and two two-hour laboratories per week.

Prerequisite: GLS 221, or permission of Department Chairperson.

GLS 330 Paleontology 4 credits

Introduction to the fossil record. Emphasis is on the description and classification of fossils and use of paleontological data to understand the principles of paleoecology, evolution, and biostratigraphy. Three lecture hours and three hours of laboratory per week. Offered alternate years.

Prerequisites: BIO 101 or BIO 103, GLS 201, or permission of Department Chairperson.

GLS 334 Sedimentation and Stratigraphy 4 credits

Introduction to the properties of sediments, sedimentary rocks, sedimentary rock sequences, and the principles of stratigraphic correlation. Emphasis is on examining the dynamics of recent sedimentary environments to establish what sediments would look like in the stratigraphic record. In laboratory, students are introduced to techniques of sediment analysis and the classification and identification of sedimentary rocks. Three lecture hours and three hours of laboratory per week. Offered alternate years.

Prerequisites: GLS 201 and GLS 210, or permission of Department Chairperson.

GLS 337 Sedimentary Petrology and Petrography 4 credits

This course is intended to serve as an in-depth investigation into the genesis, classification and interpretation of sedimentary rocks. Students will learn to analyze and collect data from both hand samples and thin sections, and to interpret that data for classification, provenance and tectonic setting. Theoretical information will enable them to understand the geological significance of sedimentary rock distribution. Three lecture hours and three laboratory hours per week.

Prerequisite: GLS 135 and GLS 201 or permission of Department Chairperson.

GLS 341 Structural Geology and Tectonics 4 credits

The study of the processes by which deformation of the earth occurs, and the interpretation of the structures produced by these processes—from submicroscopic to global scales. Three lecture hours and three hours of laboratory per week; occasional local and/or regional field trips (may be during the school week or weekends) may be required.

Prerequisites: GLS 100, MAT 202N or equivalent or permission of Department Chairperson.

GLS 342 Plate Tectonics: Theory and Implication 3 credits

A systematic treatment of the geology and geophysics of plate tectonics, based on present knowledge of the structure and physical properties of the Earth's interior. Included are present kinematics of plate movements, hypotheses of dynamics (such as mantle convection), global pattern of plates, detailed consideration of processes at plate convergences, paleoplate tectonics and continental drift of the last 200 million years as derived from ocean floor stratigraphy and structure, and inferences on the time of inception of plate tectonics and its role in earlier Earth history. Three lecture hours per week. Offered alternate years.

Prerequisites: GLS 201 or permission of Department Chairperson.

GLS 343 Introduction to Geophysics 4 credits

Introduction to seismology, earthquake mechanics, geomagnetism, gravity and terrestrial heat flow. All aspects of the course will be related to global plate tectonics. Three lecture hours and 3 laboratory hours per week; occasional local field trips (may be during the school week or weekends) may be required.

Prerequisites: GLS 210, PHS 211, or permission of the Department Chairperson.

GLS 345 Geological Engineering 3 credits

The application of Geology to the solution of civil engineering problems. Emphasis on recognition and measurement of rock, soil, and hydrologic parameters for use in site evaluation, design, analysis, and construction. Controlling factors and recognition of geologic hazard potential. Three lecture hours per week. Offered alternate years.

Prerequisites: GLS 210, GLS 341, MAT 202N, or 220 or permission of Department Chairperson.

GLS 349 Geoarcheology 3 credits DII

The use of earth science concepts, methods, equipment and knowledge in the direct solution of problems in archeology. The course will introduce students to the use of earth science methods in resolving archeological problems associated with artifact identification, integrity of artifact sets, chronological context, paleoland-scape habitat, and human environment interactions. Students will learn the use and geoarcheological application of sophisticated field equipment such as Total Stations, GPS, and remote sensing methods. A one day local field trip is required. Three lecture hours per week.

GLS 351 Economic Geology 3 credits

Occurrence, origin, and exploitation of ore minerals, petroleum, coal and other economic materials. Three lecture hours per week.

Prerequisite: GLS 322 or permission of Department Chairperson.

GLS 352 Petroleum Geology 3 credits DII

Physical and chemical nature, origin, migration, and trapping of fluid hydrocarbons. Source rocks, "pipelines", reservoir rocks, exploration techniques. Three lecture hours per week.

Prerequisite: GLS 100, or permission of Department Chairperson.

GLS 353 Geochemistry 3 credits

Origin of the elements and their geological significance. Processes affecting the evolution of the Earth's crust and the distribution of the elements in rocks, sediments, soils and waters; geochemical cycles. Students produce computer-generated graphs in regularly assigned projects throughout the semester. Three lecture hours per week. Offered alternate years.

Prerequisites: CHE 130, GLS 201 or permission of Department Chairperson.

GLS 356 Hydrology 4 credits DII

This course is intended to serve as a core in the basics of surface and groundwater hydrology for environmental science majors. Students taking this course should gain a useful understanding of hydrologic theory and some basic skills used in hydrologic data gathering and analysis. Problem solving, short in-class activities and laboratory projects related to lecture material will enhance the student's understanding of hydrologic concepts. Three lecture hours and three laboratory hours per week.

Prerequisites: CHE 130, GLS 201, GLS 210 or permission of Department Chairperson.

GLS 357 Environmental Geology 3 credits

Applied approach to environmental problems. We will focus on New England: expanding on preexisting theoretical knowledge with field trips and projects which emphasize local materials, i.e. glacial deposits, harbor sediments, crystalline rocks, and local problems. This is a lab and field oriented course intended to sharpen theory with practice. Two lecture hours and two laboratory hours per week. Field trips required, 1 weekend and several to local sites. Offered alternate years.

Prerequisites: GLS 353, GLS 356 or permission of Department Chairperson.

GLS 360 Geology of North America 3 credits DII

The stratigraphy, structure, geomorphology, and geologic history of the various sections of the continent. Economic geology of important deposits is discussed. The Plate Tectonic hypothesis is considered as it relates to the evolution of the geologic provinces. Offered only through the Evening Division. Three lecture hours per week. Offered alternate years.

Prerequisites: GLS 100 and GLS 201; GLS 210 is also recommended.



GLS 362 New England Geology **3 credits DII**
Geology of New England and adjacent regions. Major structural belts and bedrock stratigraphy. Tectonic models for past orogenic events. The impact of bedrock geology and geologic structures on New England's landscape. Two weekend field trips. Three lecture hours per week. Offered alternate years.
Prerequisite: GLS 201 or permission of Department Chairperson.

GLS 372 Surveying I **4 credits**
A lecture and laboratory study to provide theoretical knowledge and practical field experience in surveying and mapping. Specific topics to be covered are: linear measurement, leveling, angular measurement, traverse surveys, record keeping, note reduction, office calculations and adjustments, and plotting a traverse. Field operations will constitute an essential part of the course. Three lecture hours and three hours of laboratory per week.
Prerequisites: MAT 202N and MAT 205, or permission of Department Chairperson.

GLS 373 Surveying II **4 credits**
A lecture and laboratory study in advanced topics of surveying, a continuation of Surveying I. Specific topics to be covered are: geodetic and control surveys, topographic and hydrographic surveys, aerial surveys, photogrammetric applications, astronomical observations, coordinate systems, tacheometry, and horizontal and vertical curves. Field operations will be included. Three lecture hours and three hours of laboratory per week.
Prerequisites: GLS 372 and MAT 247, or permission of Department Chairperson.

GLS 380 Applied Environmental Geophysics **4 credits**
An introduction to the theory and practice of geophysical methods currently used to help solve environmental problems. Methods covered include seismic refraction and reflection, gravity, magnetic, electrical resistivity, electromagnetics, ground-penetrating radar, and radioactivity surveys. Three lecture hours and three laboratory hours per week; occasional local field trips (may be during the school week or weekends) may be required.
Prerequisites: GLS 334, PHS 211, or permission of Department Chairperson.

GLS 400 Directed Studies in the Earth Sciences **1-4 credits**
Field, laboratory and/or library research in the Earth Sciences. Independent study in the student's field of interest under the supervision of an appropriate faculty member.
Prerequisite: GLS 201 and permission of Department Chairperson.

GLS 470 Field Geology (Summer Only) **6 credits**
The application of geologic field method including mapping, structural interpretation, surveying, and stratigraphic section measurement and interpretation to the production of geologic maps. Several projects stress environmental applications. This course is field based and requires the student to work outdoors at various sites on Cape Cod and the Yellowstone Plateau in Montana/Wyoming. Transportation to and from the field areas is provided, additional fee required for field expenses. This course is offered only through the Division of Continuing Education.
Prerequisites: GLS 341; and one other upper division (200-300-400) Geology course or permission of the Department Chairperson.

GLS 485 Earth Science Study-Field Seminar **1-3 credits**
A study/field course designed around a specific field experience. The course combines one to two weeks of classroom lecture and laboratory work with a 1 week field trip to an area specific to the course content. Topic varies. May be repeated for credits with permission of the Department Chairperson. Field fee may be required.

GLS 499 Internship in Earth Science **3-9 credits**
An academic work program under the auspices of various business, non-profit or governmental organizations in areas directly related to the student's area of academic interest in Earth Science. The student will gain practical field and/or laboratory experience. The internship must be coordinated by a faculty member working in conjunction with the chosen organization. Open only to Junior and Senior Geology majors.
Prerequisite: Permission of the Department Chairperson.

GLS 500 Senior Research in Geology I (Fall) **3-4 credits**
The completion of a substantial research project on a geologic problem or topic under the supervision of an appropriate faculty member. Methods of research, organization, preparation, and presentation of data will be discussed, but the objective is a completed thesis by the student. Open only to Senior Geological Sciences majors by permission of Department Chairperson.

GLS 501 Senior Research in Geology II (Spring) **3-4 credits**
A continuation of GLS 500 for those students who wish to further pursue their geologic research, particularly in anticipation of publication.
Prerequisites: GLS 500 and permission of Department Chairperson.