

Earth and Environment

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Affiliated Faculty

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(GLOWS)
Maria Aysa, *Global and Sociocultural Studies*
Bradley Bennett, *Biological Sciences*
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Gail Hollander, *Global and Sociocultural Studies*
Rudolf Jaffe, *Chemistry and Biochemistry*
Jeff Joens, *Chemistry and Biochemistry*
B. M. Golam Kibria, *Mathematics and Statistics*
Suzanne Koptur, *Biological Sciences*
David Lee, *Biological Sciences*
Rod Neumann, *Politics and International Relations*
Steve Oberbauer, *Biological Sciences*
George O'Brien, *Education*
Laura Ogden, *Global and Sociocultural Studies*
Kevin O'Shea, *Chemistry and Biochemistry*
Stewart Reed, *US Department of Agriculture*
Laurie Richardson, *Biological Sciences*
Berrin Tansel, *Civil and Environmental Engineering*
Joel Trexler, *Biological Sciences*
Carlton Waterhouse, *Law School*
Kevin Whelan, *US Geological Survey*
Yan Yan Zhou, *Mathematics and Statistics*

Knowledge of the Earth and its environments is essential for successful stewardship of our home planet. The mission of FIU Department of Earth and Environment is to be at the forefront of research and education on the dynamic interaction of Earth's systems, the environment, and related societal issues. Programs in the department address understanding and stewardship of the natural Earth. In addition, the department fosters understanding of the planet's bounty, such as water, mineral, energy and agricultural resources. A third area of emphasis is environmental problems, both natural, such as earthquakes, volcanic eruptions and floods, and human-made, such as oil spills, ecosystem degradation and soil erosion. The Department of Earth and Environment has well-equipped facilities that allow students to not only understand the Earth and its environments, but also to rigorously prepare for professions with environmental and resources orientation.

Geoscience Programs

The Department offers a Bachelor of Sciences degree in Geosciences program with a choice of tracks in the Geological Sciences and another in Atmospheric Sciences. These tracks have been designed to prepare students to gain professional credentials such as the State of Florida Professional Geologist certification or the American Meteorological Society certification. A broader based, interdisciplinary BA program in Earth Sciences is also offered, including a major in Earth Science Education which leads to teacher certification in Florida. Also available are Minors in Geology and Meteorology. A grade of "C" or better is required for all required courses in the major and/or minor.

Bachelor of Science in Geosciences

Degree Program Hours: 120

Common Prerequisite Courses and Equivalencies

<u>FIU Course(s)</u>	<u>Equivalent Course(s)</u>
GLY 1010, GLY 1010L or	GLYX010C or
GLY 3039, GLY 3039L	GLYX010/X010L
CHM 1045, CHM 1045L	CHMX045/X045L or

	CHMX040 and CHMX041 or CHMX045C
CHM 1046, CHM 1046L	CHMX046/X046L or CHMX046C
MAC 2311	MACX311 or MTHX281
PHY 2048, PHY 2049 or PHY 2053, PHY 2054, PHY2048L, PHY 2049L	PHYX048C ¹ and PHYX049C or PHYX048/X048L and PHYX049/X049L or PHYX053C and PHYX054C and XXXXXX ²

¹The choice of Physics sequence depends on the area of Geology specialization.

²Historical Geology STRONGLY recommended.

Courses which form part of the statewide articulation between the State University System and the Community College System will fulfill the Lower Division Common Prerequisites.

For generic course substitutions/equivalencies for Common Program Prerequisites offered at community colleges, state colleges, or state universities, visit: <http://facts.org>. See Common Prerequisite Manual.

Lower Division Common Prerequisites

GLY 1010	Introduction to Earth Science	3
GLY 1010L	Introduction to Earth Science Lab	1
	or	
GLY 3039	Environmental Geology	3
GLY 3039L	Environmental Geology Lab	1
CHM 1045	CHM 1045 General Chemistry I	3
CHM 1045L	General Chemistry I Lab	1
CHM 1046	General Chemistry II	3
CHM 1046L	General Chemistry II Lab	1
MAC 2311	Calculus I	4
PHY 2048	Physics with Calculus I	4
PHY 2049	Physics with Calculus II	4
	or	
PHY 2053	Physics without Calculus I	4
PHY 2054	Physics Without Calculus II	4
PHY 2048L	General Physics Lab I	1
PHY 2049L	General Physics Lab II	1

Courses required for the degree:

MAC 2312	Calculus II	4
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Other Lower Division Courses Required for the degree For the Geological Sciences Track Only

BSC 1011	General Biology II	3
BSC 1011L	General Biology II Lab	1

For the Atmospheric Sciences Track Only

MAC 2313	Multivariable Calculus	4
MAP 2302	Differential Equations	3

Upper Division

Geosciences Essentials (13 credits)

GLY 3112	Earth Through Time*	3
GLY 4822	Introduction to Hydrogeology	3
MET 3003	General Meteorology	3
OCP 3002	Physical Oceanography	3
GLY 4937/		
MET 4937	Senior Seminar	1

[*Students may substitute Historical Geology from another institution.]

Geological Sciences Track

This track is intended for students who wish to concentration the study of the solid Earth and hydrosphere. Prepares students for graduate work in geology or careers in management of resources and environment.

1. Choose four geology courses (with labs as necessary) from List 1 (16 credits)
2. Choose an additional 9 credits or more from either List 1 or List 2, at least three of which must be field experience.

List 1: Track-specific Courses

GLY 3202	Earth Materials	3
GLY 3202L	Earth Materials Lab	1
GLY 4300	Petrology	3
GLY 4300L	Petrology Lab	1
GLY 4511	Stratigraphy	3
GLY 4511L	Stratigraphy Lab	1
GLY 4400	Structural Geology	3
GLY 4400L	Structural Geology Lab	1

List 2: Geo-elective Courses

GIS 3043	Introduction to GIS	3
GLY 3034	Natural Disasters	3
GLY 3760C	Geological Map Analysis	3
GLY 3782	Geology Field Excursion	3
GLY 4450	Environmental and Exploration Geophysics	3
GLY 4650	Paleobiology	3
GLY 4650L	Paleobiology Lab	1
GLY 4730	Marine Geology	3
GLY 4791	Field Geology and Geologic Mapping	3
GLY 4812	Introduction to Ore Deposits	3
GLY 4910	Undergraduate Research in Geology	3
GLY 4970	Geology Honors Thesis	3
GLY 4989L	Geology Honors Research	1-3
MET 4300	Severe Weather	3
MET 4400	Meteorological Instrumentation & Observations	3
MET 4532	Hurricanes	3
MET 3102	Physical Climatology	3
MET 4420	Physical Meteorology	3
MET 3502	Synoptic Meteorology	3
MET 3502L	Synoptic Meteorology Lab	1
MET 4301	Dynamic Meteorology I	3
MET 4302	Dynamic Meteorology II	3

Other courses as approved by the Earth Sciences advising office may be used.

Atmospheric Sciences Track

This track is for students who wish to concentrate on the study of the atmosphere. Prepares students for graduate work or careers in weather and climate prediction.

1. Choose four courses (with labs as necessary) from List 1 (13 credits)
2. Choose an additional 12 credits or more from either List 1 or List 2.

List 1: Track-specific Courses

MET 3102	Physical Climatology	3
	or	
MET 4420	Physical Meteorology	3

MET 3502	Synoptic Meteorology	3
MET 3502L	Synoptic Meteorology Lab	1
MET 4301	Dynamic Meteorology I	3
MET 4302	Dynamic Meteorology II	3

List 2: Geo-elective Courses

GLY 3202	Earth Materials	3
GLY 3202L	Earth Materials Lab	1
GLY 4300	Petrology	3
GLY 4300L	Petrology Lab	1
GLY 4511	Stratigraphy	3
GLY 4511L	Stratigraphy Lab	1
GLY 4400	Structural Geology	3
GLY 4400L	Structural Geology Lab	1
GIS 3043	Introduction to GIS	3
GLY 3034	Natural Disasters	3
GLY 3760C	Geological Map Analysis	3
GLY 3782	Geology Field Excursion	3
GLY 4450	Environmental and Exploration Geophysics	3
GLY 4650	Paleobiology	3
GLY 4650L	Paleobiology Lab	1
GLY 4730	Marine Geology	3
GLY 4791	Field Geology and Geologic Mapping	3
GLY 4812	Introduction to Ore Deposits	3
GLY 4910	Undergraduate Research in Geology	3
GLY 4970	Geology Honors Thesis	3
GLY 4989L	Geology Honors Research	1-3
MET 4300	Severe Weather	3
MET 4400	Meteorological Instrumentation & Observations	3
MET 4532	Hurricanes	3

Other courses as approved by the Earth Sciences advising office may be used.

Accelerated Bachelor of Science/Master of Science in Geosciences

The accelerated BS/MS degree program in Geosciences allows qualified students to earn both degrees in a shorter amount of time than typically required for earning degrees sequentially. The accelerated program is designed for highly qualified undergraduate students in the Earth Sciences, allowing them to complete their MS degree within approximately 2.5 years after starting their second year.

To be considered for admission to the combined bachelor's/master's degree program, students must have completed at least 75-90 credits in the bachelor's degree program at FIU and meet the admissions criteria for the graduate degree program to which they are applying. Students need only apply once to the combined degree program, but the application must be submitted to Graduate Admissions before the student starts the last 30 credits of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and be eligible for graduate assistantships. Only 5000-level or higher courses, and no more than the number of credits specified by the program catalog, may be applied toward both degrees.

Admission Requirements

- Current enrollment in the Bachelor of Science program in Geosciences at FIU.
- Completed at least 90 credits of coursework (including UCC and CLAS).
- Minimum GPA of 3.2.
- Minimum GRE (verbal + quantitative) score of 1000.
- Three letters of recommendation.
- Approval by the Earth Sciences Graduate Committee.

General Requirements

- Meet the requirements of both the BS and MS degree in Geosciences.
- *Overlap:* Up to 3 courses (9 credits) may be used in satisfying **both** the BS and MS degree requirements, which must be at the 5000-level or higher.

Bachelor of Arts in Earth Sciences

Degree Program Hours: 120

This program is for the student who requires a broad background in Earth Sciences for a career in science education or public or private administration dealing with Earth and environmental science issues.

Common Prerequisite Courses and Equivalencies

Courses which form part of the statewide articulation between the State University System and the Community College System will fulfill the Lower Division Common Prerequisites.

For generic course substitutions/equivalencies for Common Program Prerequisites offered at community colleges, state colleges, or state universities, visit: <http://facts.org>. See Common Prerequisite Manual. The Common Prerequisite Manual does not include a sheet for this program.

Lower Division

CHM 1045	General Chemistry I
CHM 1045L	General Chemistry I Lab
CHM 1046	General Chemistry II
CHM 1046L	General Chemistry II Lab
GLY 1010	Introduction to Earth Science
GLY 1010L	Introduction to Earth Science Lab
MAC 2311	Calculus I
PHY 2053	Physics without Calculus I
PHY 2048L	General Physics Lab I
PHY 2054	Physics without Calculus II
PHY 2049L	General Physics Lab II
	and
GLY 1100	Historical Geology
GLY 1100L	Historical Geology Lab
	or
GLY 1101	History of Life
GLY 1101L	History of Life Lab

Upper Division

GLY 3202	Earth Materials	3
GLY 3202L	Earth Materials Lab	1
OCE 3014	Oceanography	3
	and	

THREE of the following:

GLY 3760C	Geological Map Analysis	3
GLY 4822	Introduction to Hydrogeology	3
GLY 4511	Stratigraphy &	3
GLY 4511L	Stratigraphy Lab	1
GLY 4300	Petrology &	3
GLY 4300L	Petrology Lab	1
GLY 4400	Structural Geology &	3
GLY 4400L	Structural Geology Lab	1

and**ONE** of the following (3-4):

EVR 3013	Ecology of South Florida &	3
EVR 3013L	Ecology of South Florida Lab	1
EVR 4211	Water Resources &	3
EVR 4211L	Water Resources Lab	1
EVR 4231	Air Resources	3
EVR 4310	Energy Resources	3
EVR 4592	Soils & Ecosystems &	3
EVR 4592L	Soils & Ecosystems Lab	1
GEO 3510	Earth Resources	3
GLY 3034	Natural Disasters	3

Additional Courses

Students take two approved 3000 or 4000 level courses in earth sciences/geology (excluding GLY 3039 Environmental Geology), other science departments, or the College of Engineering.

Earth Science Education Major

This program prepares students interested in Earth Sciences and science for teaching at the secondary level. Students are encouraged to participate in on-campus teaching experiences that parallel their coursework, available for freshman and sophomores. Interested students are encouraged to contact the department for additional details and information on teacher support programs.

Lower Division**Common Prerequisites as Detailed Under the BA Degree in Earth Sciences****Additional Lower Division Courses (4)**

AST 2003	Solar System Astronomy	3
AST 2003L	Solar System Astronomy Lab	1

Upper Division

ESC 3050	Seminar in Earth Science Education	1
OCE 3014	Oceanography	3
GLY 3202	Earth Materials	3
GLY 3202L	Earth Materials Lab	1
GLY 4937	Senior Seminar in Geological Sciences	1

and**THREE** of the following (10-12 credits):

GLY 3760C	Geological Map Analysis	3
GLY 4822	Introduction to Hydrogeology	3
GLY 4511	Stratigraphy &	3
GLY 4511L	Stratigraphy Lab	1
GLY 4300	Petrology &	3
GLY 4300L	Petrology Lab	1
GLY 4400	Structural Geology &	3
GLY 4400L	Structural Geology Lab	1

and**ONE** of the following (3-4 credits):

EVR 3013	Ecology of South Florida &	3
EVR 3013L	Ecology of South Florida Lab	1
EVR 4211	Water Resources &	3
EVR 4211L	Water Resources Lab	1
EVR 4231	Air Resources	3
EVR 4310	Energy Resources	3
EVR 4592	Soils & Ecosystems &	3
EVR 4592L	Soils & Ecosystems Lab	1
GEO 3510	Earth Resources	3
GLY 3034	Natural Disasters	3

Additional Course

ESC 4052	Inquiry-Based Learning in the Earth Sciences	3
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AND (23 credits)

SCE 4894	Nature of Math and Science	3
SCE 4194	Perspectives on Science Education	3
SCE 4330	Secondary Science Teaching Methods	3
SCE 4944	Student Teaching	6
SCE 4931	Senior Seminar in Science Education	2
RED 4325	Subject Area Reading	3
TSL 4324	ESOL Issues and Strategies for Content Teachers	3

Electives

9-12

BS/BA Honors Track in Geosciences

The Honors Track in Geosciences provides outstanding students with the opportunity to do original research under a faculty sponsor. To graduate with Honors, the student must carry out a research project, write up the project as an Honors Thesis, and present the results of the research in a Departmental seminar.

Admission to the Track

To be admitted to the track a student must:

- Have arranged to be sponsored by a faculty advisor.
- Have taken at least 14 hours of Geoscience/Earth Science courses with a GPA of at least 3.5; 6 hours must be at the 3000 level or above.
- Have an overall GPA of 3.5 or higher in 3000 and 4000 level classes.
- Exceptions to these criteria may be granted in special cases through appeal to the Earth Sciences Undergraduate Committee.

Application to the program is made by submission of the Honors in Geosciences Admission Form to the Earth Sciences Undergraduate Committee. This is usually done in the semester before the student intends to begin the Honors thesis research.

Graduation Requirements

- A minimum GPA of 3.5 in courses in 3000 and 4000 level classes.
- Completion of the B.S. requirements in Geosciences or B.A. requirements in Earth Sciences, including GLY 4989L (Honors Research, 3 credits) and GLY 4970 (Honors Thesis, 3 credits).
- Completion of Honors research in collaboration with Honors supervisor and presentation of a draft of the Honors thesis to the Earth Sciences Undergraduate Committee.

- Deposition of a completed approved copy of the Honors thesis with the Earth Sciences office.

Minor in Geology

Required courses

At least 17 hours of earth sciences/geology courses which must include the following: GLY 1010+1010L or GLY 3039+3039L, GLY 1100+1100L or GLY 1101+1101L, and GLY 3202+3202L. Additional earth sciences/geology courses must be taken at the 3000 or 4000 level.

Minor in Meteorology

This minor is intended for science/math/engineering majors who wish to develop an understanding of meteorology. Students from other majors who have math/science background and literacy can also take this minor. Calculus I or Business Calculus, and Physics I are pre- or co-requisites for General Meteorology. The minor consists of at least 16 credits of courses within the Department of Earth Sciences.

Required Courses: (10 credits)

MET 3003	General Meteorology	3
MET 4420	Physical Meteorology	3
	or	
MET 3102	Physical Climatology	3
MET 3502	Synoptic Meteorology	3
MET 3502L	Synoptic Meteorology Lab	1

Plus, any two of the following courses (6+ credits):

MET 4300	Severe Weather	3
MET 4532	Hurricanes	3
OCE 3014	Oceanography	3
OCE 3014L	Oceanography Lab	1
MET 4400	Meteorological Instrumentation and Observations	3
MET 4301	Dynamic Meteorology I	3
MET 4302	Dynamic Meteorology II	3

Cooperative Education

Students seeking the baccalaureate degree in Geosciences/Earth Sciences may also take part in the Cooperative Education Program conducted with the Department of Cooperative Education in the Division of Student Affairs. The student spends one or two semesters fully employed in the private sector or a government agency. For further information consult the Department of Earth and Environment or the Department of Cooperative Education.

Environmental Studies Programs

The program prepares students for work and involvement in environmental professions and issues. The Bachelor of Sciences in Environmental Studies degree emphasizes chemical and ecological aspects of environmental analysis. The Bachelor of Arts degree in Environmental Studies is emphasizes the political, social and economic aspects of environmental issues. This is an interdisciplinary program that represents chemistry to anthropology, and may feature affiliated faculty from other departments in some courses. Note that the Department

offers a Minor and a certificate program in Environmental Studies. A grade of "C" or better is required for all required courses in the major, minor and certificate.

Bachelor of Science in Environmental Studies

Degree Program Hours: 120

To qualify for admission to the program, FIU undergraduates must have met all the lower division requirements including CLAS, completed 60 semester hours, and must be otherwise acceptable into the program.

Lower Division Preparation

Common Prerequisite Courses and Equivalencies

<u>FIU Course(s)</u>	<u>Equivalent Course(s)</u>
BSC 1010, BSC 1010L	BSCX010/X010L or BSCX010C
BSC 1011, BSC 1011L	BSCX011/X011L or BSCX011C
CHM 1045, CHM 1045L	CHMX045/X045L or CHMX045C
CHM 1046, CHM 1046L	CHMX046/X046L
GLY 1010, GLY 1010L	GLYX010 or GLYX039 and
EVR 3010 or PHY 2023	EVRX010 or PHYX023
MAC 2147 or MAC 1105 and MAC1114	MACX147 or MACX105 and MACX114 ECOX023 ¹

¹Requirement or option for FIU program.

Courses which form part of the statewide articulation between the State University System and the Community College System will fulfill the Lower Division Common Prerequisites.

For generic course substitutions/equivalencies for Common Program Prerequisites offered at community colleges, state colleges, or state universities, visit: <http://facts.org>. See Common Prerequisite Manual.

Required Courses

Common Prerequisites

BSC 1010	General Biology I
BSC 1010L	General Biology I Lab
BSC 1011	General Biology II
BSC 1011L	General Biology II Lab
CHM 1045	General Chemistry I
CHM 1045L	General Chemistry I Lab
CHM 1046	General Chemistry II
CHM 1046L	General Chemistry II Lab
GLY 1010	Introduction to Earth Science
GLY 1010L	Introduction to Earth Science Lab
	and
EVR 3010	Energy Flow in Natural and Man-made Systems
	or
PHY 2023	Survey of General Physics
MAC 2147	Pre-Calculus Mathematics
	or
MAC 1105	College Algebra
	and
MAC 1114	Trigonometry

Lower or Upper Division Requirements

ECO 2023	Microeconomics	3
STA 3111	Statistics I	3
STA 3112	Statistics II	3
	or	
MAC 2311	Calculus I	4
CHM 2200	Survey of Organic Chemistry	3
CHM 2200L	Survey of Organic Chemistry Lab	1
	or	
CHM 2210	Organic Chemistry I	4
CHM 2210L	Organic Chemistry I Lab	1
	and	
CHM 2211	Organic Chemistry II	3
CHM 2211L	Organic Chemistry II Lab	1

Upper Division Program**Recommended Courses**

ANT 3403	Cultural Ecology	3
ENC 3213	Professional and Technical Writing	3
POS 2042	American Government	3
	or	
POS 3424	Legislative Process	3
REL 3492	Earth Ethics	3

Required Courses

ECP 3302	Introduction to Environmental Economics	3
EVR 4352	U.S. Environmental Policy	3
	or	
POS 4035	Environmental Politics	3
EVR 4211	Water Resources	3
EVR 4211L	Water Resources Lab	1
PCB 3043	Ecology	3
PCB 3043L	Ecology Lab	1
CHM 3120	Analytical Chemistry and	3
CHM 3120L	Analytical Chemistry Lab	1
	or	
EVR 4323	Restoration Ecology and	3
EVR 4323L	Restoration Ecology Lab	1
EVR 4920	Environmental Studies Senior Seminar	1
EVR 4905	Independent Study	2
Two of the following four courses:		
EVR 4026	Ecology of Biotic Resources	3
EVR 4231	Air Resources	3
EVR 4310	Energy Resources	3
EVR 4592	Soils and Ecosystems and	3
EVR 4592L	Soils and Ecosystems Lab	1

2 Additional Environmental Courses (6 credits)

Students are urged to develop an area of specialization of 12 to 15 credits, or a minor, in consultation with an advisor. An approved list of such courses are published prior to each semester.

Total Semester hours 60

Bachelor of Arts in Environmental Studies

Degree Program Hours: 120

Lower Division Program**Recommended Courses**

PSC 1515	Energy and the Natural Environment
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To qualify for admission to the program, FIU undergraduates must have met all the lower division requirements including CLAS, completed 60 semester hours, and must be otherwise acceptable into the program.

Common Prerequisite Courses and Equivalencies

Courses which form part of the statewide articulation between the State University System and the Community College System will fulfill the Lower Division Common Prerequisites.

For generic course substitutions/equivalencies for Common Program Prerequisites offered at community colleges, state colleges, or state universities, visit: <http://facts.org>. See Common Prerequisite Manual. The Common Prerequisite Manual does not include a sheet for this program.

Common Prerequisites

ECO 2023	Principles of Microeconomics
BSC 1011/1011L	Organismal Biology and Lab
<i>One of the following:</i>	
CHM 1032/1032L	Chemistry & Society and Lab
GLY 1010/1010L	Introduction to Earth Sciences and Lab

To qualify for admission to the program, FIU undergraduates must have met all the lower division requirements including CLAS, completed 60 semester hours, and must be otherwise acceptable into the program.

Upper Division Program**Recommended Courses**

ENC 3213	Professional & Technical Writing	3
POS 2042	American Government	3
STA 3112	Statistics II	3
POS 3424	Legislative Process	3

Required Courses: (35)

EVR 3010	Energy Flow in Natural and Man-made Systems	3
EVR 3011	Environmental Resources and Pollution	3
EVR 3011L	Environmental Resources and Pollution Lab	1
EVR 4594	Analysis of South Florida Ecosystems	3
EVR 4596L	Applied Field Ecology	2
EVR 4415	Population & Environment Issues	3
	or	
ANT 3403	Cultural Ecology	3
EVR 4352	US Environmental Policy	3
	or	
POS 4035	Environmental Politics	3
REL 3492	Earth Ethics	3
STA 3111	Statistics I	3
ECP 3302	Introduction to Environmental Economics	3
EVR 4411	Human Organization & Ecosystems Management	3
EVR 4905	Independent Study	2
EVR 4920	Environmental Studies Senior Seminar	1
EVR 4869L	Environmental Problem Solving Lab	2

Area of Specialization Courses: (12)

The student must take at least twelve additional credits in an approved area of specialization, such as resource management/policy, international environmental issues, agroecology, human ecology/environmental values, environmental education or environmental biology. Six of the 12 credits must be from EVR courses. **Note:** Minors may be substituted for an area of specialization.

Electives 16
Total semester hours 60

Accelerated Master's of Science in Environmental Studies

To be considered for admission to the combined bachelor's/master's degree program, students must have completed at least 75-90 credits in the bachelor's degree program at FIU and meet the admissions criteria for the graduate degree program to which they are applying. Students need only apply once to the combined degree program, but the application must be submitted to Graduate Admissions before the student starts the last 30 credits of the bachelor's degree program. A student admitted to the combined degree program will be considered to have undergraduate status until the student applies for graduation from their bachelor's degree program. Upon conferral of the bachelor's degree, the student will be granted graduate status and be eligible for graduate assistantships. Only 5000-level or higher courses, and no more than the number of credits specified by the program catalog, may be applied toward both degrees.

Admission Requirements

- Current enrollment in the Bachelor's Degree Program in EVR at FIU.
- Completed or enrolled in at least 90 undergraduate credit hours.
- Current GPA of 3.25 or higher.
- GRE combined score of 1000 (quantitative and verbal).

General Requirements

- Completed Bachelor's Degree in EVR at FIU.
- EVR 5320 Environmental Resource Management can substitute for EVR 4023 Biotic Resources for BS majors and be taken as an elective/area of concentration by BA majors.
- BA and BS majors can take EVR 5355 Environmental Resource Policy instead of EVR 4352 US Environmental Policy.
- Two-Three graduate electives (6-9 credits) can be counted towards areas of concentration for BA majors, or as electives or resource courses for BS majors.
- Take one section of EVR Graduate Seminar for EVR 4920 Undergraduate Senior Seminar.
- Students are expected to have 12-18 graduate course credits by the time they receive the undergraduate degree.

Minor in Environmental Studies**Required Courses**

1. Four of the following approved courses, including at least two of the first four.

EVR 4026	Ecology of Biotic Resources	3
EVR 4211	Water Resources	3
EVR 4231	Air Resources	3
EVR 4310	Energy Resources	3
EVR 4401	Conservation Biology	3
EVR 4323	Restoration Ecology	3

2. One of the following courses:

EVR 4415	Population and Environment Issues	3
EVR 4321	Sustainable Resource Development	3
EVR 4352	US Environmental Policy	3
Total Credits		15

Grades of 'C' or better required for all courses. A list of additional approved environmental science courses, subject to change, is available in the Department of Environmental Studies.

Cooperative Education

Students seeking the baccalaureate degree in environmental studies may also take part in the Cooperative Education Program conducted in conjunction with the Department of Cooperative Education in the Division of Student Affairs. The student spends one or two semesters fully employed in industry or a governmental agency. For further information consult the Department of Cooperative Education.

Environmental Internships

Students are highly encouraged to participate in an environmental internship while completing their program of study. Approved internships can satisfy students independent study requirements. Each year, during the Spring, the department will hold an internship and career fair in order to help guide students towards internships. For details on internships, please contact Dr. Raymond Scattone.

Course Descriptions

Note: Laboratories may not be taken prior to the corresponding lecture course. Laboratories must be taken concurrently where noted, but students must register for the laboratory separately.

Definition of Prefixes

ESC-Earth Sciences; EVR-Environmental Studies; EVS-Environmental Science; GEO-Geography: Systematic; GIS-Geography: Information Science; GLY-Geology; MET-Meteorology; OCE- Oceanography; OCP-Physical Oceanography; SWS-Soil and Water Sciences
 F-Fall semester offering; S-Spring semester offering; SS-Summer semester offering.

ESC 3050 Seminar in Earth Science Education (1).

Seminar covering theoretical and practical issues encountered in the teaching of Earth Sciences. Students will discuss experience gained as learning assistants.

Prerequisites: GLY 1010 and GLY 1010L, GLY 1101 and GLY 1101L and permission of the instructor.

ESC 3930 Topics in Earth Sciences (1-5). Selected topics in the earth sciences.

ESC 4052 Inquiry-Based Learning in the Earth Sciences (3). Important concepts in the Earth Sciences covered using inquiry based learning techniques. Content delivery using laboratory exercises and technology. Prerequisite: Permission of the instructor.

ESC 5005 Earth Science Enrichment Activities for Teachers (1-2). Workshop presenting Earth Science enrichment activities to high school and middle school science teachers.

ESC 5162 Workshop: Microfossil Paleoenvironments (2). Recent foraminifera and diatoms are sampled, prepared and identified from marine to freshwater facies. Taxon distributions are used to interpret paleoenvironments. Prerequisite: Permission of the instructor.

EVR 1001 Introduction to Environmental Sciences (3). A physical science course for non-science majors, emphasizing air and water pollution, water resources, solid waste management, and energy resources. (F,S, SS)

EVR 1001L Introduction to Environment Sciences Lab (1). Laboratory analysis and field trips on topics and concepts covered in Introduction to Environmental Sciences. (F,S,SS)

EVR 1017 The Global Environment and Society (3). A broad introduction to the impact of social and economic processes on the global environment, including historical and comparative dimensions. (F, S, SS)

EVR 3003 Latin American Environmental Issues (3). An overview of historical and emerging environmental issues in Latin American countries. Themes covered include environmental history, urban pollution, tropical deforestation, and indigenous peoples.

EVR 3010 Energy Flow in Natural and Man-made Systems (3). A course for non-science majors, examining energy use and efficiency, nuclear and renewable energy sources (including solar energy), and their environmental impacts. Prerequisites: College algebra or equivalent. (S)

EVR 3011 Environmental Resources and Pollution (3). A course for non-science majors, focusing on dynamics of pollution and environmental toxicology with emphasis on energy consumption and production, solid wastes, and air and water resources. (F)

EVR 3011L Environmental Science: Pollution Lab (1). Laboratory and field analysis of topics and concepts covered in EVR 3011. Corequisite: EVR 3011. (F)

EVR 3013 Ecology of South Florida (3). **EVR 3013L Ecology of South Florida Lab (1).** A course for non-science majors, offering an introduction to the ecology of South Florida through lectures and a series of field trips into several unique ecosystems, such as the Everglades, hardwood hammocks, and coastal regions. The course also deals with natural resource conservation, wildlife management, endangered species, and wilderness issues. (F,S,SS)

EVR 3029 The Everglades (3). An interdisciplinary examination of the Everglades system, including natural history, human history, esthetics, and politics/policy of restoration.

EVR 3402 Asian Environmental Issues (3). An overview of emerging environmental issues in Asian countries. Discussion of cultural, economic, and political systems of the region and their influence on the environment.

EVR 3931 Topics in Environmental Studies (3). An intensive analysis of a current environmental topic. Course may be repeated with change in content.

EVR 3949/EVR 4949 Cooperative Education in Environmental Studies (1-3). One semester of full-time supervised work in an outside laboratory taking part in the University Co-op Program. Limited to students admitted to the Co-op Program. A written report and supervisor evaluations will be required of each student. (F,S,SS)

EVR 4023 Coastal Resource Management (3). An introduction to the basic concepts, principles, and analytical tools used in the management of coastal resources.

EVR 4026 Ecology of Biotic Resources (3). The study of renewable natural resources of the earth's biomes, particularly those of tropical forests, the factors influencing their productivity, conservation, and human use. Prerequisites: BSC 1010 and BSC 1011.

EVR 4112 Climate Change Policy (3). Introduction to policies governing climate change mitigation. Examines the impetus for, specific mechanisms used to implement, and effectiveness of both national and international policies. Prerequisites: EVR 4352 or permission of the instructor.

EVR 4211 Water Resources (3). A seminar dealing with various aspects of water use, water pollution problems, chemistry and ecology of South Florida's waters. Ecology is recommended. Prerequisites: CHM 1045 and CHM 1046 or equivalent and general biology. (F)

EVR 4211L Water Resources Lab (1). Laboratory course on procedures currently suitable and widely accepted for physical, chemical, and biological methods in the examination of water. Prerequisites: CHM 1045 and CHM 1046 or equivalent and General Biology. (F)

EVR 4231 Air Resources (3). Common air pollutants - their sources and methods of control. Different legislative and administrative approaches will be studied. Prerequisites: CHM 1045 and CHM 1046 or equivalent.

EVR 4272 Agroecology (3). Application of ecological principles to modern farming systems to achieve goals of long term food production without depleting Earth's resources. Prerequisites: EVR 3013 or equivalent or permission of the instructor. (F)

EVR 4274 Sustainable Agriculture (3). Analysis of sustainability of modern agricultural systems under a variety of ecological economic and cultural settings. Familiarizes students with socioeconomic, urban policy, sustainable agriculture. Prerequisites: EVR 3013 or equivalent or permission of the instructor. (S)

EVR 4310 Energy Resources (3). Seminar dealing with power and energy production in modern society, fundamental energy relationships of industrial and domestic processes. Prerequisites: EVR 3010 or PHY 2023 or equivalent.

EVR 4321 Sustainable Resource Development (3). An overview of social, economic and ecological approaches to sustainable resource development. Examines various policies for harmonizing economic growth and environmental sustainability.

EVR 4323 Restoration Ecology (3). Principles and practices of environmental restoration, recreation and enhancement. Examines ecological theory that relates to restoration through case studies from southern Florida. Prerequisites: EVR 3013 or PCB 3043 or permission of the instructor. (S)

EVR 4323L Restoration Ecology Lab (1). This lab is to illustrate concepts and applications of ecological restoration theories through visitations to and participations in various ecological restoration sites in South Florida. Prerequisites: At least one class in the area of Ecology. Corequisite: EVR 4323.

EVR 4351 U.S. Energy Policy (3). Policies governing the utilization of energy in the U.S. Focuses on the physical, political and social constraints that shape energy policy in this country. Prerequisites: EVR 3010 or permission of the instructor.

EVR 4352 U.S. Environmental Policy (3). Introduction to U.S. environmental policy. Reviews primary U.S. environmental legislation and the role of regulation. Prerequisites: EVR 3011 or permission of the instructor. (F)

EVR 4356 Coastal and Marine Environmental Policy (3). Examine policies that govern the utilization and protection of coastal and marine areas. Focus on the political, social, environmental and economic constraints that shape the policy process.

EVR 4401 Conservation Biology (3). Applies modern theory from ecology and population genetics to conservation issues. Topics include population viability studies, reserve design, forms of rarity, and policy issues. Prerequisites: BSC 1010 and BSC 1011.

EVR 4411 Human Organizations and Ecosystem Management (3). Environmental aspects of organizational theory and strategic management in indigenous and other local communities, non-governmental organizations, governments, and the private sector are discussed. Prerequisite: An introductory Environmental Studies course. (F)

EVR 4415 Population and Environment Issues (3). Examines the history, current status and projected growth of the human population in relation to environmental issues. Prerequisites: College algebra, STA 3111 (or equivalent), EVR 3011 or permission of the instructor. (S)

EVR 4592 Soils and Ecosystems (3). A review of basic soil science concepts; analyses of basic physical and chemical properties of soils, emphasizing soils in South Florida ecosystems. Prerequisites: BSC 1010 and CHM 1045, or permission of the instructor.

EVR 4592L Soils and Ecosystems Lab (1). Laboratory exercises provide soil characterization techniques used in soil science and complement the lectures by carrying out experiments illustrating soil science concepts, soil formation, soil properties, and soil nutrients cycling. Prerequisites: CHM 1046, BSC 1011, CHM 3120 and their corresponding labs. Corequisite: EVR 4592.

EVR 4594 Analysis of South Florida Ecosystems (3). In-depth study, using case study approach of the major ecosystems of South Florida, the environmental issues facing them, and the management strategies employed to sustain their natural resources. Prerequisites: BSC 1011, BSC 1011L, EVR 3011. (S)

EVR 4596L Applied Field Ecology (2). Introduction to basic methodologies of applied field ecological research; builds ability to identify major plant and animal species and community assemblages in South Florida. Prerequisites: BSC 1011, BSC 1011L, EVR 3011. (S)

EVR 4869L Environmental Problem Solving Lab (2). Provides first-hand experience in solving environmental problems (problem definition, study design, data collection, analysis & reporting). Includes use of case study, social survey, computer modeling and GIS techniques. Prerequisites: STA 3111, ECO 2023, EVR 3010, and EVR 3011, or permission of the instructor. (F)

EVR 4905 Research and Independent Study (VAR). Student develops and carries out research project with guidance from professor. Permission of the instructor.

EVR 4920 Environmental Studies Senior Seminar (1). Series of talks by FIU and external experts addressing both development of professional skills and current environmental topics. Students prepare short presentations. For seniors only. (F,S)

EVR 4924 Environmental Education (3). Principles and methods of teaching sustainable living, personal and institutional, emphasizing S. Florida, using reading, discussion, projects and visits to local EE programs. Prerequisites: Two courses in environmental studies; or two courses, one each in biology, chemistry, environmental studies or science education.

EVR 4934 Special Topics (1-3). Advanced undergraduate level course dealing with selected environmental topics. Course may be repeated with change in content. (F,S)

EVR 5005 Environmental Science and Sustainability (3). Introductory environmental science course for graduate students in environmental studies and other disciplines. Emphasizes physical sciences and applications to environmental issues. (F)

EVR 5044 Advanced GIS and Environmental Data Analysis (3). Explores project planning, geospatial database design and implementation of analytical and display methods in GIS for organizing, querying, analyzing and presenting spatial data. Prerequisites: One of the following: EVR 5050, CGN 4321, CGN 5320, INR 4931, URS 6930.

EVR 5061 South Florida Ecology: Field Studies (3). Introduction to ecology of South Florida. Series of field trips to unique ecosystems (Everglades, hard-wood

hammocks, coastal regions). No science background required. Intended for teachers. Not intended for Environmental Studies graduate students. (F,S)

EVR 5065 Ecology of Costa Rican Rainforest (3). Intensive study of Central American tropical forest ecosystems conducted for two weeks in Costa Rica in sites ranging from lowland to high mountains. Primarily for teachers. Prerequisites: Graduate standing or permission of the instructor.

EVR 5066 Ecology of the Amazon Flooded Forest (3). Study of the ecology of the flooded forest with emphasis on the relationships between plants and animals and the annual flooding cycle. The course includes a two-week field study at river camp in Peru. Prerequisites: Graduate standing or permission of the instructor.

EVR 5069 Wetland Ecology and Management (3). Principles of ecology and management as applied to freshwater and estuarine wetlands. Prerequisites: Undergraduate degree in science, or PCB 3043, or permission of the instructor.

EVR 5215 Water Resources Assessment (3). Elements of hydrological cycle, hydrological processes and water resources assessment with emphasis on surface and groundwater water quantity and quality evaluation is central to the course.

EVR 5236 Air Pollution Dynamics (3). A course designed to give an understanding of the fates of atmospheric pollutants. Scavenging processes in the atmosphere; radiation, residence times, chemical reactions, global transport process, point source dispersion and modeling calculations. Prerequisites: EVS 3360 or EVR 4231.

EVR 5313 Renewable Energy Sources (3). An analysis of renewable energy sources and energy efficiency including wind, biomass, geothermal, hydroelectric, solid waste, solar heating, solar cooling, and solar electricity. Prerequisite: Permission of the instructor.

EVR 5315 Energy Resources and Systems Analysis (3). Detailed analysis of energy flows in natural and man-made systems. Energy systems analysis. Energy use patterns. Conventional and alternate sources of energy.

EVR 5320 Environmental Resource Management (3). The scientific and philosophical basis for the management of renewable and non-renewable energy, mineral, air, water, and biotic resources. Prerequisites: Graduate standing or permission of the instructor. (S)

EVR 5332 Integrated Solutions for Water in Environment and Development (3). Examines the theory and practice of integrated water resources management, focusing on science, policy, and socioeconomic themes evaluated through case studies from different regions of the world. Emphasis given to environmental elements.

EVR 5350 International Organizations & Environmental Politics (3). The role of international organizations in environmental politics and the process of their formation and change in response to environmental problems. Prerequisites: Graduate standing or permission of the instructor.

EVR 5353 International Energy Policy (3). Focuses on the distribution of global energy resources and related issues. A comparison of the energy policies of various countries serves as the basis for exploring alternative energy policy approaches. Prerequisites: EVR 5355 or permission of the instructor.

EVR 5355 Environmental Resource Policy (3). A survey of international and national environmental policy and the legal, economic, and administrative dimensions of international accords and selected U.S. law. Prerequisites: EVR 5320 or permission of the instructor. (F)

EVR 5410 The Human Population and Earth's Ecosystems (3). Explores the impact of the human population of Earth's ecosystems. Reviews current population data at global, regional, and local scales. Includes study of specific South Florida carrying capacity issues.

EVR 5907 Research and Independent Study (VAR). The student works with a professor on a research project. Variable credit.

EVR 5935 Special Topics (VAR). A graduate-level course dealing with selected environmental topics. The content will not necessarily be the same each time the course is offered. (F,S)

EVR 5936 Topics in Environmental Studies (3). An analysis of several current environmental topics. Recommended for primary and secondary school teachers.

EVS 4164 Applied Environmental Geology (3). **EVS 4164L Applied Environmental Geology Lab (1).** A survey of the geological and geographical factors critical to man's attempt to contend with the natural processes. Construction problems, sewers, waste disposal, dams, ground water, and terrain evaluation in relation to the nature of the underlying substratum. Principles illustrated from South Florida and the Caribbean region in particular. Study of the geological factors involved in future development and growth of these areas, and conservation methods in relation to the geology of these areas. Prerequisites: GLY 1010, GEO 2200, and a sound background in mathematics, physics, and chemistry. Laboratory must be taken concurrently with the course. (S in alternate years)

GEO 2200 Physical Geography (3). **GEO 2200L Physical Geography Lab (1).** Survey of the physical environment relevant to studies in regional geography and earth sciences. Natural evolution of landforms, and the interacting processes responsible for these features. Environmental modification and deterioration caused by human interaction. Effects of these changes: socioeconomic impact and geographic problems. Case studies illustrated from South Florida and the Caribbean region. (F in alternate years.)

GEO 3510 Earth Resources (3). A course for non-majors dealing with the nature, origin, and distribution of mineral resources. Geology of petroleum, coal, metals, etc., and problems of their exploitation and depletion. (F,S,SS)

GEO 3510L Earth Resources Laboratory (1). Introduction to minerals and rocks used by society. Case

studies of geologic, environmental and economic aspects of resource extraction and use. Corequisite: GEO 3510.

GIS 3043 Introduction to Geographical Information Systems (3). Introduction to GIS concepts and software such as ArcView. Topics include: cartographic basics, spatial datasets, attributes, map production, spatial statistics and analysis, and obtaining GIS data.

GIS 5050 Environmental GIS (3). Concepts of GIS, database design and management, advanced spatial analysis and modeling, uncertainty, error, and sensitivity in GIS. Focus on GIS project design, execution and presentation using AroGIS. Prerequisite: Permission of the instructor.

GLY 1010 Introduction to Earth Science (3). **GLY 1010L Introduction to Earth Science Lab (1).** Basic survey of Earth materials and structure, plate tectonics, volcanoes, earthquakes, surface processes and groundwater, climate change, earth resources and the impact of geology on society. (Lab fees assessed) (F,S,SS)

GLY 1037 Environmental Hydrology for High School Students (1). Environmental issues surrounding the natural occurrence and human use of surface water and groundwater in South Florida. Includes field trips to local sites of hydrologic/environmental significance.

GLY 1100 Historical Geology (3). **GLY 1100L Historical Geology Lab (1).** An introduction to the geological history of the earth and the geological time scale. Evolution of animals and plants. Prerequisites: GLY 1010 or GLY 3039 or equivalent. Lecture and lab must be taken concurrently. (S)

GLY 1101 The History of Life (3). **GLY 1101L The History of Life Laboratory (1).** Interaction of biological and geological principles and processes, history and ecology of past life, and major events such as the marine invasion of land, mass extinctions, and the Ice Age. (F,S)

GLY 2072 Earth's Climate and Global Change (3). Introduction to Earth's climate and the variations of climate through geological and historical time. Emphasis is placed on the importance of the interactions of Earth's crust, atmosphere, biosphere and oceans in affecting the planet's climate. (F in alternate years)

GLY 2072L Earth's Climate and Global Change Lab (1). Practical analysis of the important factors affecting Earth's Climate. Analysis of historical and geological records of climate change. Corequisite: GLY 2072. (F in alternate years)

GLY 3034 Natural Disasters (3). A geological look at catastrophic events including earthquakes, volcanoes, tsunamis, mass movements, hurricanes, floods, and desertification. Emphasis on the geologic setting in which these natural disasters take place. Special attention will be given to compare similar disasters in the geologic past. Prerequisite: Physical science at the high school level. (F,S,SS)

GLY 3039 Environmental Geology (3). **GLY 3039L Environmental Geology Lab (1).** The composition and structure of the earth, the internal and external forces acting upon it and the resulting surface features. Case

studies and general principles illustrated from South Florida and the Caribbean. Field trips expected. No prerequisites. (F,S,SS)

GLY 3103 Dinosaurs (3). Survey of the different groups of dinosaurs. Dinosaur biology, geology, and the history of their discovery to further understanding of their life histories, environments, and the causes of their extinction.

GLY 3103L Dinosaurs Laboratory (1). Survey of the different groups of dinosaurs. Laboratory study of dinosaur bones, prints and eggs to further our understanding of their life histories, environments, and the causes of their extinction. Corequisite: GLY 3103.

GLY 3112 Earth through Time (3). Evolution of the Earth through its 4600 million year history, the fossil record and the geologic time scale. Major geologic events of the past and their effects on organic evolution. (S)

GLY 3153 Workshop in South Florida and Caribbean Geology (2). Workshop on the geology of South Florida and the Caribbean for science majors. Includes field trips in South Florida. Prerequisite: Permission of the instructor.

GLY 3157 Elements of Caribbean Geology (3). A survey of the geology of the Caribbean and neighboring regions in view of current data and modern concepts of global tectonics. The course summarizes the important points of Caribbean and Central American geology in their relation to mineral and energy resources; natural environmental disasters, especially seismic zones; agriculture; and the geologic potential for future development and industrialization. (S in alternate years)

GLY 3202 Earth Materials (3). Physical and chemical properties of minerals and mineral assemblages, such as rocks and soils. Processes of mineral formation. Prerequisites: GLY 1010 or permission of the instructor and General Chemistry. Corequisite: GLY 3202L. (F)

GLY 3202L Earth Materials Lab (1). Physical and chemical properties of minerals, rocks and soils with emphasis on identification. Application of macroscopic methods, X-ray diffraction, polarized light microscopy, in situ and bulk chemical analysis. Prerequisites: GLY 1010 and GLY 1010L or permission of the instructor and General Chemistry. Corequisite: 3202. (F)

GLY 3220 Optical Mineralogy (3). **GLY 3220L Optical Mineralogy Lab (1).** Principles and use of the petrographic microscope. Optical properties of isotropic, uniaxial and biaxial minerals. Prerequisites: GLY 3202 or equivalent. Laboratory must be taken concurrently with course.

GLY 3630 Research in Tropical Environments (3). Earth Sciences, Biology and Environmental Studies faculty describe research in marine and terrestrial ecosystems, geology, conservation and education. Students discuss scientific articles.

GLY 3751 Introduction to Mineral Science (2). Workshop introducing properties and uses of minerals, and techniques used to investigate minerals. Prerequisites: One of the following: BSC 1010, CHM 1045, PHY 2053, GLY 1010. (SS)

GLY 3754 Remote Sensing in the Earth Sciences (3). Remote sensing methods for the exploration and investigation of geologic processes and earth resources; airphoto interpretation, processing and analysis of multiband digital satellite imagery; GIS. Prerequisites: GLY 1010 or permission of the instructor. (F)

GLY 3759 Visualizing Our World With GIS (3). Visualization of geospatial data in the Earth Sciences with Geographic Information Systems. Topics include natural hazards, distribution of water, mineral, and energy resources, and urban sprawl. (SS)

GLY 3760C Geological Map Analysis (3). Laboratory course dealing with analysis of geological maps and sections; theory and method of interpretation of surface outcrops on maps. Properties of simple geological structures. Recommended to be taken prior to GLY 4400 and GLY 4791. Prerequisites: Trigonometry, Introduction to Earth Science or equivalent (e.g. MAC 2132, GLY 3039 or equivalents). (F)

GLY 3782 Geology Field Excursion (1-3). A one to three-week field excursion in a region of interest to demonstrate the occurrence, appearance and processes of various geological phenomena. Course may be repeated. Prerequisite: GLY 1010. (F,S,SS)

GLY 3820 Applied Hydrogeology of South Florida (2). Workshop introducing hydrogeology of South Florida, and laboratory and field techniques used to study groundwater. Prerequisites: One of the following: BSC 1010, CHM 1045, PHY 2053, GLY 1010.

GLY 3881 Environmental Geology Field Methods (3). Introduction to commonly used field methods in environmental geology including site evaluation, bore-hole geophysical and hydrogeological techniques, and topographic map skills. Prerequisites: GLY 1010 or GLY 3039.

GLY 3882 Environmental Geology Florida Keys Workshop (2). Workshop introducing environmental geology of the Florida Keys, Bay-Island-Reef transect. Prerequisites: One of the following: BSC 1010, CHM 1045, PHY 2053, GLY 1010, or equivalent. (SS)

GLY 3949/GLY 4949 Cooperative Education in Geology (1-3). One semester of full-time supervised work in an outside laboratory taking part in the University Co-op Program. Limited to students admitted to the Co-op Program. A written report and supervisor evaluations will be required for each student. (F,S,SS)

GLY 4036 Earth Sciences and Society (3). Explores the new directions of Earth Science studies and examines how they can enhance society's ability to make wise decisions on resource development, waste disposal, natural hazards. Prerequisites: GLY 1010 or GLY 3039.

GLY 4300 Petrology (3). Origin, composition and classification of igneous, sedimentary, and metamorphic rocks. Observational, theoretical, and experimental studies of rocks. Prerequisite: GLY 3202. (S)

GLY 4300L Petrology Lab (1). Identification of rocks using macroscopic and microscopic techniques. Application of electron microprobe. Prerequisite: GLY 3202. (S)

GLY 4400 Structural Geology (3). **GLY 4400L Structural Geology Lab (1).** Faults, folds, fractures and other rock structures; their description and representation on maps and diagrams; mechanics of their formation. Prerequisites: GLY 1010 or equivalent; knowledge of trigonometry and algebra. (F)

GLY 4450 Environmental and Exploration Geophysics (3). Introduction to geophysical methods used in exploration and environmental geophysics. Seismic methods; potential fields; electrical and EM methods; ground penetrating radar; geophysical well logging. Prerequisites: GLY 1010 or 3039; MAC 2312; PHY 2049 or 2054; or permission of the instructor. Corequisite: GLY 4450L.(S)

GLY 4450L Environmental and Exploration Geophysics Laboratory (1). Acquisition and interpretation of exploration geophysical data. Seismic, gravity, magnetic, and geoelectrical methods; geophysical well logging. 4-5 field trips to sites in Dade County expected. Prerequisites: GLY 3760C or GLY 4400 or permission of the instructor. Corequisite: GLY 4450. (S)

GLY 4511 Stratigraphy (3). Stratigraphic principles applied to interpreting the rock record. Sediments, depositional environments and dynamics in the sedimentary record. Stratigraphic correlation and the development of the Geologic Time Scale. Prerequisite: GLY 3202. (F)

GLY 4511L Stratigraphy Lab (1). Laboratory analysis of rock facies and index fossils used in the interpretation of the geologic record. Prerequisite: GLY 3202L. (F)

GLY 4551 Sedimentology (3). **GLY 4551L Sedimentology Lab (1).** Sedimentary processes in the geological cycles, as illustrated in recent environments. Different groups of sedimentary rocks. Primary and secondary sedimentary structures. Physicochemical properties and diagenetic processes. Analytical techniques applied to modern sedimentology of both loose and lithified sediments. Prerequisites: Introduction to Earth Science or equivalent; Earth Materials and Stratigraphy and a sound background in mathematics and chemistry. Laboratory must be taken concurrently with course. (S)

GLY 4650 Paleobiology (3). **GLY 4650L Paleobiology Lab (1).** Development of life as traced through the fossil record. Survey of the main groups of animals commonly found as fossils. Theories of evolution and extinction. Study of the major fossil groups used in biostratigraphic zonation, and as paleoecologic indicators. Prerequisites: Physical and historical geology, general biology, or permission of the instructor. Laboratory must be taken concurrently with course.

GLY 4660 Paleocology (3). Fossils, sedimentary rocks, taphonomy, and stable isotopes of oxygen and carbon are applied to interpreting local environmental changes and regional to global climate changes of the past.

GLY 4730 Marine Geology (3). **GLY 4730L Marine Geology Lab (1).** Survey of the main physiographic provinces of the ocean floor. Modern theories concerning the evolution of the crust; continental drift, seafloor spreading. Distribution and thickness of deep-sea

sediments, and their relationship to the morphology and evolution of the crust. Deep-sea mineral resources. Marine geology of the Caribbean from recent data. Sea-bed assessment of mineral resources in the Caribbean and neighboring region. Prerequisites: OCE 3014, GLY 1010, or permission of the instructor. Laboratory must be taken concurrently with course.

GLY 4791 Field Geology and Geologic Mapping (3-6).

A three-to six-week field instruction and practice in methods of constructing stratigraphic sections, structural cross sections and geologic mapping using topographic base maps, aerial photos, and surveying equipment. Prerequisites: GLY 4511 and GLY 4511L, GLY 4400 and GLY 4400L. (SS)

GLY 4812 Introduction to Ore Deposits (3).

Major classes of metal deposits, their geologic settings and genetic theories, and case studies of great deposits. Environmental, economic and legal aspects of metal extraction, processing and use. Prerequisites: GLY 1010, GLY 1010L or GLY 3039, GLY 3039L. (S)

GLY 4822 Introduction to Hydrogeology (3).

Principles of groundwater flow, determination of aquifer properties, geologic factors influencing groundwater flow and quality, legal/regulatory framework for hydrogeology. Prerequisites: One college-level course in physics, chemistry, geology, and calculus, or permission of the instructor. (S)

GLY 4822L Introduction to Hydrogeology Lab (1).

Principles of groundwater flow, determination of aquifer properties, geologic factors influencing ground water flow and quality. Prerequisites: CHM 1045, GLY 1010, PHY 2053, MAC 2311, or equivalent. Corequisite: GLY 4822.

GLY 4823 Florida Geologic and Hydrologic Systems (3).

Survey of geological formations of Florida and their relationship to hydrologic and mineral resources. Sedimentary facies in relation to their hydrologic properties. Prerequisites: GLY 4822 and GLY 4511 or permission of the instructor.

GLY 4910, GLY 4911 Undergraduate Research in Geology (VAR).

Individual research under the supervision of a professor in the student's field of specialization or interest. Subject may deal with laboratory work, field, and/or bibliographical work. Field research in the Caribbean is encouraged. Variable credit to a maximum of 10 credits. Permission of the student's advisor is required. (F,S,SS)

GLY 4937 Senior Seminar in Geological Sciences (1).

Geosciences topics are researched, presented and discussed by students. Students develop knowledge of current research trends and written and verbal science communication skills. Prerequisites: Senior standing in BS in Geosciences, Geological Sciences Track, or BA in Earth Sciences program.

GLY 4970 Geology Honors Thesis (3). Preparation of honors thesis and research seminar. Prerequisite: GLY 4989L.

GLY 4989L Geology Honors Research (1-3). Laboratory and/or field study in consultation with a faculty advisor. Prerequisite: Admission into Geology honors track.

GLY 5021 Earth Sciences for Teachers (3). Study of geological materials and processes, as covered in Introduction to Earth Science, but at a higher level and with additional assignments. Prerequisite: Permission of the instructor. Corequisite: GLY 5021L. (F,S,SS)

GLY 5021L Earth Sciences for Teachers Laboratory (1).

Study of the properties of minerals and rocks; interpretation of topographic and geologic maps; study of the geology of Florida, including field trips. Prerequisite: Permission of the instructor. Corequisite: GLY 5021. (F,S,SS)

GLY 5060 Plant Earth: Dynamic Earth (1). Essentials of metamorphism, rock rheology, seismology, plate tectonics, plate boundaries, plate movement, continental rifting and evolution of mountain belts.

GLY 5107 Planet Earth: Evolving Earth (1). Essentials of lithostratigraphy, biostratigraphy, geologic time scale, modern sedimentological processes, sedimentary rocks, evolution and extinction events, paleoenvironments and paleoclimates.

GLY 5108 Paleoenvironments (3). Sedimentary environments, paleoecology of fossils, skeletal mineralogy, marine paleoenvironmental changes, global patterns of change through time. Prerequisite: Permission of the instructor.

GLY 5158 Florida Geology (3). Detailed lithostratigraphic and biostratigraphic analyses of Southeast Florida and their relationship to tectonics, paleoclimates. Prerequisites: GLY 4511 and GLY 4511L. (S in alternate years)

GLY 5159 Planet Earth: South Florida (1). Geology, water resources and geologic environments of South Florida.

GLY 5195 Topics in Paleoclimatology (3). Broad concepts in paleoclimatology are reviewed and discussed. Topics include climate models, Quaternary climates, dating and pre-Quaternary climates. Prerequisite: Permission of the instructor.

GLY 5245 Water-Rock Interaction (3). Survey of geochemical processes at the water-rock interface. Topics include absorption of inorganic and organic ions, colloid stability in groundwater, mineral dissolution and precipitation. Prerequisites: CHM 1046, MAC 3312, GLY 4822 or permission of the instructor.

GLY 5246 Geochemistry (3). **GLY 5246L Geochemistry Lab (1).** Origin of chemical elements and principles affecting their distribution in the solar system, solid earth and hydrosphere. Use of chemical data to solve geologic problems. Prerequisites: Introduction to Earth Science and General Chemistry. (F in alternate years)

GLY 5266 Stable Isotope Biogeochemistry (3). Application and theory of stable isotope approaches to biogeochemistry. Topics: Introduction to IRMS machines, C/N/O/H/S (biogeochem. processes), sampling/lab. prep., and recent advances. Prerequisites: One year of chemistry or permission of the instructor.

GLY 5283C Application of ICPES in Geochemistry (3). Determination of elemental abundances in rocks, soils,

natural water using inductively coupled plasma emission spectroscopy (ICPES). Instrumental principles, sample selection and preparation methods and application of results to research. Prerequisites: CHM 1045, CHM 1046 or permission of the instructor. (S or SS)

GLY 5286 Research Instrumentation and Techniques in Geology (3). Survey of techniques and instrumentation used in geological research, including computing and data handling. Prerequisites: Graduate standing or permission of the instructor. Corequisite: GLY 5286L. (F)

GLY 5286L Research Instrumentation and Techniques in Geology Lab (1). Introduction to advanced instrumentation and analytical techniques in Geology, including computing and data processing. Prerequisites: Graduate standing or permission of the instructor. Corequisite: GLY 5286. (F)

GLY 5287C Scanning Electron Microscopy with EDS Analysis (3). Imaging and microanalysis of materials using SEM including EDS. Prerequisite: Permission of the instructor.

GLY 5288C Electron Microprobe Microanalysis with EDS Analysis (3). Imaging and analysis of geological and other materials using electron microprobe with EDS analysis. Prerequisite: Permission of the instructor.

GLY 5298 Topics in Geochemistry (3). Seminar covering current research in selected areas of low-temperature geochemistry: oceans and oceanic sediments; continental waters and sediments; hydrothermal systems. Prerequisites: GLY 5246 or permission of the instructor.

GLY 5322 Igneous Petrology and Geochemistry (3). Presentation and discussion of current topics in igneous petrology and geochemistry in a seminar format. Prerequisite: Permission of the instructor. (S) (F)

GLY 5329 Planet Earth: Solid Earth (1). Essentials of the formation and evolution of the crust mantle and core of the earth. Composition and physical properties. Generation of magmas, their geochemistry.

GLY 5335 Metamorphic Geology (3). Metamorphic mineralogy; characteristics of low, medium and high pressure metamorphic rocks; pressure-temperature determinations; metamorphic textures; modeling and determination of P-T-t paths. (F in alternate years)

GLY 5335L Metamorphic Geology Lab (1). Petrographic examination of metamorphic rocks. (F)

GLY 5346 Sedimentary Petrology (3). Systematic study of sedimentary rocks. Special emphasis on genetical aspects, geochemistry, paleontology, mineralogy, and microfacies. Emphasizes microscopic study. Prerequisite: GLY 4551. Corequisite: GLY 5346L. (F in alternate years)

GLY 5346L Sedimentary Petrology Lab (1). Laboratory studies of sediments and sedimentary rocks with emphasis on microscopic analyses and geochemical techniques. Prerequisites: GLY 4551 and GLY 4551L. Corequisite: GLY 5346. (F in alternate years)

GLY 5408 Advanced Structural Geology (3). Advanced treatment of the theory of rock mechanics to solve problems of natural rock deformation. Prerequisites: GLY

4400, MAC 2313, or permission of the instructor. Corequisite: GLY 5408L. (S)

GLY 5408L Advanced Structural Geology Lab (1). Problem solving in theory of rock deformation. Experimental procedures in rock mechanics. Corequisite: GLY 5408. (S)

GLY 5415 Caribbean Geology and Tectonics (3). Integration of geologic and geophysical data to understand the evolution and present tectonic configuration of the Caribbean area. Prerequisite: Permission of the instructor.

GLY 5425 Tectonics (3). Properties of the lithosphere; plate kinematics and continental drift; characteristics of plate boundaries; mountain belts; formation of sedimentary basins. Prerequisites: GLY 1010, 1100, 4400, 4300, 3202 or permission of the instructor. (S)

GLY 5457 Geophysical Data Analysis (3). Computer analysis and modeling of geophysical data and digital images. Statistical description of data, linear inverse theory, digital signal and image processing. Computer exercises with MATLAB. Prerequisites: GLY 4450, MAP 2302, MAS 3105, PHY 2048, PHY 2049 or permission of the instructor. Corequisite: GLY 5457L. (S)

GLY 5457L Analysis of Geophysical Data Lab (1). Field and laboratory applications of geophysical techniques. Computer aided analysis and three-dimensional modeling of gravity and magnetic data. Prerequisites: GLY 4450, PHY 2048, PHY 2049, MAC 2311, MAC 2312, MAP 2302. Corequisite: GLY 5457. (S)

GLY 5495 Seminar in Geophysics (2). Detailed investigation of current geophysical techniques, including topics on instrument design. Prerequisites: GLY 5457 or permission of the instructor. (F/S)

GLY 5497 Topics in Structural Geology and Tectonics (3). Selected advanced topics in structural geology and rock deformation. Latest advances in crustal tectonics. Prerequisite: GLY 5408. (F/S)

GLY 5599 Seminar in Stratigraphy (3). Discussion of research projects and/or current literature in stratigraphic correlation as derived from sedimentologic principles and biozonation. Prerequisite: GLY 5346. (F)

GLY 5608 Advanced Paleontology I (3). Discussion of current literature and research projects on evolution, systematics functional morphology, with reports by members of the seminar. Prerequisites: GLY 4650 or permission of the instructor. (F)

GLY 5621 Caribbean Stratigraphic Micropaleontology (3). Microscopic study of biostratigraphic type sections from the Caribbean area. Emphasis on planktonic foraminifera and radiolaria, paleoecologic and paleoclimatic interpretations. Prerequisites: GLY 4650 or permission of the instructor. (F)

GLY 5628 Radiogenic Isotope Methods (3). Theory and practice of radiogenic isotope ratio measuring techniques. Use of class-100 clean room facilities, and introduction to thermal ionization mass spectrometry. Prerequisite: General Chemistry.

GLY 5655 Topics in Paleobiology (1-3). Various concepts in paleobiology are reviewed and discussed,

based on readings of the literature, including journal articles and books. Prerequisite: Permission of the instructor.

GLY 5710 Watershed Hydrology (3). Hydrologic processes on watershed, water budgets, effects on water quality, field investigative methods using tracers and hydrometric measurements, hydrologic and hydrochemical models.

GLY 5754 Applied Remote Sensing in the Earth Sciences (3). Application of remote sensing and image analysis in the earth sciences; qualitative and quantitative satellite image and air photo interpretation. Emphasis is on use of computer processing packages. Prerequisites: GLY 1010 or permission of the instructor.

GLY 5758 GIS and Spatial Analysis for Earth Scientists (3). Application of GIS technology to spatial problems in the Earth Sciences. Topics include: spatial statistics, sampling theory, surface estimation, map algebra, and suitability modeling.

GLY 5785 Caribbean Shallow-Marine Environments (3). Field study of multiple tropical environments in the Caribbean area. Dynamic processes and coastal evolution in response to natural and human-induced changes.

GLY 5786 Advanced Field Excursion (1-6). A study of the geology of a selected region of the world followed by 10-12 day field trip in order to study the field relationships of the geologic features. Special emphasis is given to stratigraphic, structural and tectonic relationships of lithic package. Prerequisite: Permission of the instructor. (SS)

GLY 5808 Mining Geology (3). Application of theoretical models of ore formation to exploration and the use of geochemical and geophysical techniques in the search for ore deposits. Prerequisites: GLY 4300 and CHM 1046. (F/S)

GLY 5816 Economic Geology (3). Economically important metal deposits of sedimentary, igneous and hydrothermal origins and their geologic settings and characteristics. Prerequisites: GLY 1010, GLY 4300, CHM 1045, CHM 1046. (F)

GLY 5826 Hydrogeologic Modeling (3). Techniques used in modeling groundwater flow and solute transport in geologic systems. Case studies of significant aquifers. Prerequisites: GLY 5827, MAP 2302, or permission of the instructor. (S,SS)

GLY 5827 Hydrogeology (3). Physics of flow in geological media. Saturated and unsaturated flow, groundwater and the hydrologic cycle, estimating hydraulic parameters of aquifers, introduction to chemical transport. Prerequisites: GLY 1010, MAC 2312, and PHY 2053, or permission of the instructor. (F)

GLY 5827L Hydrogeology Lab (1). Laboratory, field, and computer exercises to complement GLY 5827. (F)

GLY 5828 Chemical Hydrogeology and Solute Transport (3). Quantitative analysis of hydrologic, geologic, and chemical factors controlling water quality and the transport and fate of organic and inorganic solutes in the subsurface. Prerequisite: GLY 5827. (S)

GLY 5834 Field Hydrogeology (3). Field methods in hydrogeology. Drilling, logging, wells, data loggers, hydraulic conductivity/transmissivity measurements, purging, field chemistry parameter measurements, sampling methods. Prerequisites: GLY 4822 or permission of the instructor.

GLY 5835 Introduction to Lattice Boltzmann Methods (3). The course will provide an introduction to Lattice Boltzmann methods for fluid dynamics simulation. Emphasis on multiphase fluids. Prerequisites: Programming Skills, graduate standing, permission of the instructor.

GLY 5889 Geology for Environmental Scientists and Engineers (3). Characterization of rocks and rock masses; geological maps; seismic hazards; weathering of rocks; hydrologic cycle; slope stability; coastal processes; geophysical techniques. Course includes field trips in the South Florida region. Prerequisites: CHM 1045, GLY 1010, or permission of the instructor. (S)

GLY 5931 Graduate Seminar (1). Presentation or critical examination of current research problems in geology. A selection of topics is considered each term. Topics may also include individual research in the student's field of investigation. Prerequisites: Graduate standing or permission of the instructor. (F,S,SS)

MET 3003 General Meteorology (3). A quantitative introduction to the Earth's atmosphere. Topics include tropical and mid-latitude weather, clouds and convection, solar and infrared radiation, general circulation and climate, and an overview of meteorological dynamics. Prerequisites: PHY 2048 or PHY 2053 or permission of the instructor.

MET 3014 Meteorological Dynamics I (3). A first course in the motions of the Earth's atmosphere. Topics include meteorological coordinates, atmospheric equations of motion, circulation and vorticity, balanced flows, boundary-layers and friction, and atmospheric waves. Prerequisites: MAC 2312, PHY 2048.

MET 3015 Meteorological Dynamics II (3). Second course in the motions of the Earth's atmosphere. Topics include two-dimensional Rossby waves, baroclinic instability, tropical dynamics, and general circulation. Prerequisites: MAC 2313, PHY 2048, or permission of the instructor.

MET 3102 Physical Climatology (3). Climate and its global distribution, the climate controls and processes, the influences of climate on the environment.

MET 3502 Synoptic Meteorology (3). Atmospheric fluid dynamics applied to mid-latitude weather systems. Four dimensional analysis of weather systems and forecasts. Prerequisite: MET 3003.

MET 3502L Synoptic Meteorology Laboratory (1). Development of diagnostic techniques for understanding of weather systems, using modern technological tools (e.g., we-based data, Doppler radar, satellite and real-time mesoscale models) to do weather forecasting. Prerequisite: MET 3003.

MET 4300 Severe Weather (3). Local wind systems, thunderstorms, squall lines, mesoscale convection

systems, hurricanes, and their interactions with synoptic scale systems. Prerequisites: MET 3003.

MET 4301 Dynamic Meteorology I (3). Air motion in rotating coordinates, pressure forces, hydrostatic balance, energy balance, and momentum and mass conservation, circulation and vorticity. Prerequisites: PHY 2048, PHY 2049.

MET 4302 Dynamic Meteorology II (3). Physical mechanisms that control synoptic-scale air motion in mid-latitude, Rossby waves, mesoscale circulations, and general circulations. Prerequisites: PHY 2048, PHY 2049, MET 4301.

MET 4400 Meteorological Instrumentation and Observations (3). Calibration and operation of basic meteorological sensors used to measure temperature, atmospheric flow, pressure, and moisture, including satellite and radar. Prerequisites: PHY 2048, MET 3003.

MET 4420 Physical Meteorology (3). Solar and infrared radiation, first and second thermodynamic law, entropy, phase change, physics of moist air and aerosols, condensation, clouds and precipitation formation processes. Prerequisites: PHY 2048, PHY 2049, MET 3003.

MET 4532 Hurricanes (3). Hurricane formation, motion, and impacts for undergraduates and beginning graduate students in engineering, physical sciences and social sciences. Prerequisite: Permission of the instructor.

MET 4750 Calculations for the Atmospheric Sciences (3). Calculations in Meteorology with emphasis on use of MatLab in dynamics, data analysis, and graphics. Prerequisites: MET 3003 and one other 3000 or 4000-level MET course.

MET 4910 Undergraduate Research in Meteorology (1-10). Individual research under the supervision of a professor in the student's field of interest. May involve observational, modeling, or bibliographic investigations. Variable credit up to 10 credits. Prerequisites: MET 3003, one other 3000 or 4000-level MET course, and permission of the instructor.

MET 4937 Senior Seminar in Atmospheric Science (1). Geoscience topics are researched, presented and discussed by students. Students develop knowledge of current research trends and written and verbal science communication skills. Prerequisites: Senior standing in BS in Geosciences, Atmospheric Science Track.

MET 4941 Internship in Meteorology (1-3). Practical meteorological work experience at a local media outlet, forecast office, or laboratory and supervised by a professor in the student's field of interest. May be repeated for credit. Prerequisites: MET 3003, one other 3000 or 4000-level MET course, and permission of the instructor.

MET 5305 Boundary Layer Meteorology (3). General survey of boundary meteorology. Topics include atmospheric boundary layer, (ABL), role in exchange and circulation, use in interpreting wind, temperature, and moisture distribution, hurricane boundary layer wind, and turbulent structures. Prerequisites: PHY 2048 and PHY 2049.

MET 5311 Dynamic Meteorology I (3). To study atmospheric phenomena on a rotating planet. It intends to lead towards an understanding of the theories of the atmospheric motion by applying concepts of Math., thermodynamics, and dynamics. Prerequisites: PHY 2048, PHY 2049.

MET 5530 Hurricane Meteorology and Impacts (3). Hurricane formation, motion, and impacts on the graduate level. Adds critical reading of the scientific and disaster literatures and quantitative problem sets to the undergraduate experience. Prerequisite: Permission of the instructor.

OCE 2001 Introduction to Oceanography (3). The oceans, their nature and extent. Water of the oceans, chemical balance. Marine provinces, sediments and their relation to sea life and oceanic circulation, coastal provinces, sediments and their relation to sea life and oceanic circulation, coastal and deep-ocean circulation. Waves, tides, tsunamis. One field trip expected. (F,S,SS)

OCE 3014 Oceanography (3). The ocean origin, physical properties, salinity, temperature, sound. Radiative properties, heat budget and climatic control. Tides, wind-driven motion-monsoon circulation. El Nino phenomenon. Subsurface water masses. Oceanic circulation and paleoclimates. (F,S,SS)

OCE 3014L Oceanography Lab (1). Laboratory investigation of the chemical and physical properties of seawater, ocean water motion and its effects. Corequisite: OCE 3014.

OCP 3002 Physical Oceanography (3). An in depth understanding of the physical properties of the ocean including morphology, chemistry, waves, tides, currents and its interactions with the atmosphere and coastline. Prerequisites: CHM 1045 and PHY 2048 or PHY 2053.

SWS 4303 Soil Microbiology (3). Examines biology of soil microorganisms and biologically-mediated chemical transformations occurring in soil ecosystems. Standard soil microbiology techniques will be emphasized. Prerequisites: MCB 3020 or instructor's permission.

SWS 5305 Advanced Soil Resources Analysis (3). A review of soil science concepts: analysis of physical and chemical properties of soils and nutrient cycling, emphasizing the soils of South Florida. Prerequisites: BSC 1010, BSC 1011, CHM 2210, CHM 2211; or permission of the instructor.