

MARINE SCIENCES

Program Overview

The Marine Sciences major prepares students for meaningful and productive post-baccalaureate employment and/or admission to high-quality graduate programs. The program is interdisciplinary in nature, both in its curriculum and faculty, and encompasses the biological, physiochemical, and geological aspects of marine science. Small class size, inquiry-based laboratory experiences, extensive field work, and opportunities for research experiences provide students with a strong foundation and the skills required for a wide range of potential careers.

Curriculum Overview

The curriculum for this major focuses on the interdisciplinary nature of the Marine Sciences by offering a broad and challenging selection of courses, with emphasis on the biological, physical, chemical, and geological sub-disciplines of the marine sciences and the connections between them. Upper-level courses in these sub-disciplines follow a series of foundational courses in the earth and ocean sciences, biology, chemistry, physics, and mathematics. All marine sciences majors will participate in extensive laboratory and fieldwork in their courses, exploring a rich diversity of marine environments and processes while learning the technical and analytical skills necessary for such work. Students also will complete a Marine Sciences field course offered by Earth & Chemical Sciences and taught most recently at the Roatan Institute of Marine Sciences (RIMS), Roatan, Honduras. In addition, students are encouraged to take advantage of the many opportunities to engage in independent research in collaboration with the Earth & Chemical Sciences faculty.

Student Learning Outcomes

Graduates of the Marine Sciences major will be able to:

1. The student can combine relevant data with scientific principles to compose an explanation of natural phenomena in marine sciences.
2. The student can use physical, chemical, and biological characteristics to identify materials or organisms that form the foundation of their discipline.
3. The student can properly use technical equipment and associated techniques to collect, organize, and interpret field data.
4. The student can identify, find, evaluate, and use information to produce scientific reports, both written and orally, for scientific research and communication.

Honors Program in Marine Sciences

Honors in Marine Sciences are awarded in recognition of majors who have demonstrated outstanding academic ability. Enrollment in the Honors Program is by invitation of the department faculty. Eligibility requirements include a minimum GPA of 3.5 in courses required for the major and the satisfactory completion of a senior thesis or a three- or four-credit Independent Research and Study course related to their major. In addition, an honors candidate must maintain an overall minimum GPA of 3.0.

Degree Offered

- B.S. in Marine Sciences

Contact

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Program Website: Marine Sciences (<https://www.rider.edu/academics/colleges-schools/college-arts-sciences/science-technology-math/undergraduate/marine-sciences/>)

Associated Department: Earth & Chemical Sciences (<https://www.rider.edu/academics/colleges-schools/college-arts-sciences/science-technology-math/faculty-departments/earth-chemical-sciences/>)

Related Programs

- Earth and Environmental Sciences
- Earth Sciences (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/earth-sciences/>) (for Secondary Education majors)
- Environmental Sciences (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/environmental-sciences/>)
- Environmental Studies (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/environmental-studies/>)
- Geology (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/geology/>)

Marine Sciences Major Requirements

(65-66 credits)

Code	Title	Credits
Geological, Environmental, and Marine Sciences		
ENV 200 & 200L	Statistical and Computer Applications in the Natural Sciences and Statistical and Computer Applications in the Natural Sciences Lab	4
ENV 320 & 320L	Global Biogeochemistry and Global Biogeochemistry Lab	4
GEO 100	Earth Systems Science	3
GEO 102	Earth Materials and Processes Lab	1
GEO 306 & 306L	Sedimentology and Stratigraphy and Sedimentology and Stratigraphy Lab	4
MAR 120	Oceanography	3
MAR 121	Introductory Oceanography Lab	1
MAR 340	Marine Processes and Environments: Seminar	3
MAR 401 & 401L	Marine Ecology and Marine Ecology Lab	4
MAR 410	Physical Oceanography	3
Field Experience		
MAR 300	Introduction to Field Marine Science	4
Biology		
BIO 115 or BIO 116	Principles of Biology I or Principles of Biology II	4

BIO 272 & 272L	Intro to Marine Biology and Marine Biology Laboratory	4
Chemistry		
CHE 120 & CHE 121	Principles of Chemistry and Principles of Chemistry Lab	4
CHE 122 & CHE 123	Intro to Chemical Systems and Quantitative Methods Lab	4
Mathematics		
Select one; also satisfies CLAS core requirement		
MTH 105	Algebra and Trigonometry	
MTH 210	Calculus I	
Physics		
PHY 100 & 100L	Principles of Physics I and Principles of Physics I Lab	4
Electives		
Select two of the following:		7-8
BIO 372 & 372L	Behavior of Marine Organisms: Evolutionary Approach and Behavior of Marine Organisms: Evolutionary Approach Lab	
ENV 205	Introduction to Geographic Information Systems	
MAR 210 & 210L	Marine Life through Time and Marine Life through Time Lab	
MAR 325 & 325L	Marine Vertebrates and Marine Vertebrates Lab	
MAR 360 & 360L	Plankton Ecology and Plankton Ecology Lab	
Total Credits		65-66

Marine Sciences Minor Requirements

(23-24 credits)

Marine Sciences majors may not select this minor.

Code	Title	Credits
Select one of the following:		
BIO 115 & 115L	Principles of Biology I and Principles of Biology I Lab	4
OR		
BIO 116 & 116L	Principles of Biology II and Principles of Biology II Lab	
Required Courses:		
BIO 272 & 272L	Intro to Marine Biology and Marine Biology Laboratory	4
GEO 100 & GEO 102	Earth Systems Science and Earth Materials and Processes Lab	4
MAR 120 & MAR 121	Oceanography and Introductory Oceanography Lab	4
Select one of the following:		4
MAR 300	Introduction to Field Marine Science	
MAR 380	The Learning and Teaching of Marine Science	
Electives		
Select one of the following:		3-4
ENV 320 & 320L	Global Biogeochemistry and Global Biogeochemistry Lab	

GEO 306 & 306L	Sedimentology and Stratigraphy and Sedimentology and Stratigraphy Lab	
MAR 325 & 325L	Marine Vertebrates and Marine Vertebrates Lab	
MAR 360 & 360L	Plankton Ecology and Plankton Ecology Lab	
MAR 410	Physical Oceanography	
Total Credits		23-24

Academic Plan of Study

The following educational plan is provided as a sample only. Rider students who do not declare a major during their freshman year; who are in a Continuing Education Program; who change their major; or those who transfer to Rider may follow a different plan to ensure a timely graduation. Each student, with guidance from his or her academic advisor, will develop a personalized educational plan.

Course	Title	Credits
Year 1		
Fall Semester		
CMP 120	Seminar in Writing and Rhetoric	3
MAR 120	Oceanography	3
MAR 121	Introductory Oceanography Lab	1
BIO 115	Principles of Biology I	4
BIO 115L	Principles of Biology I Lab	0
MTH 105	Algebra and Trigonometry ¹	4
Semester Credit Hours		15
Spring Semester		
CMP 125	Seminar in Writing and Research	3
GEO 100	Earth Systems Science	3
GEO 102	Earth Materials and Processes Lab	1
Social Perspectives		3
Foreign Language		3
Aesthetic Perspectives: Fine Arts		3
Semester Credit Hours		16
Year 2		
Fall Semester		
CHE 120	Principles of Chemistry	3
CHE 121	Principles of Chemistry Lab	1
ENV 200	Statistical and Computer Applications in the Natural Sciences	4
ENV 200L	Statistical and Computer Applications in the Natural Sciences Lab	0
BIO 272	Intro to Marine Biology	4
BIO 272L	Marine Biology Laboratory	0
Foreign Language ¹		3
Semester Credit Hours		15
Spring Semester		
CHE 122	Intro to Chemical Systems	3
CHE 123	Quantitative Methods Lab	1
Social Perspectives		3
Philosophical Perspectives		
Aesthetic Perspectives: Literature		3

Elective Course ²		3
Semester Credit Hours		13
Year 3		
Fall Semester		
PHY 100	Principles of Physics I	3
PHY 100L	Principles of Physics I Lab	1
GEO 306	Sedimentology and Stratigraphy	4
GEO 306L	Sedimentology and Stratigraphy Lab	0
HIS 150	World History to 1500	3
Elective Course ²		3
Semester Credit Hours		14
Spring Semester		
ENV 320 & 320L	Global Biogeochemistry and Global Biogeochemistry Lab	4
HIS 151	World History Since 1500	3
Two Elective Courses ²		6
Semester Credit Hours		13
Summer Semester		
MAR 300	Introduction to Field Marine Science	4
Semester Credit Hours		4
Year 4		
Fall Semester		
MAR 340	Marine Processes and Environments: Seminar	3
MAR 410	Physical Oceanography	3
Three Elective Courses ²		9
Semester Credit Hours		15
Spring Semester		
MAR 401	Marine Ecology	4
MAR 401L	Marine Ecology Lab	0
Four Elective Courses ²		12
Semester Credit Hours		16
Total Credit Hours for Graduation		121

Note: Natural and Physical Science core requirements are included in the major.

1

For course placement information see <https://www.rider.edu/student-life/first-year-experience/orientation/placement-testing> (<https://www.rider.edu/student-life/first-year-experience/orientation/placement-testing/>)

2

Please note that elective credits may be used to complete requirements in a second major or minor.

Courses and Descriptions

MAR 120 Oceanography 3 Credits

In this course, students will investigate the geological, chemical, physical, and biological processes that shape the ocean. Emphasis will be placed on how these processes interact with each other and with human populations. These interactions influence important global phenomena that impact all our lives, including weather and climate, the distribution of marine organisms and other natural resources, and coastal processes. Understanding these phenomena will enable students to make more informed decisions and contribute to serious global marine issues. Students will learn through a combination of hands-on exercises designed to foster a deeper understanding of the scientific content as well as the scientific process, practical experiences with real data, readings, and some lectures. CLAS general education areas addressed: DP & GP.

MAR 121 Introductory Oceanography Lab 1 Credits

This lab course introduces students to the fundamental aspects of geological, chemical, physical and biological oceanography. Students learn through inquiry-based, hands-on exercises and activities using actual data collected in the lab and in the field. Independent projects and local field trips during lab and on weekends may be required. One three-hour lab per week. This course counts towards the fulfillment of the Disciplinary Perspectives element of the CLAS general education curriculum.

Corequisite(s): MAR 120 or GLS 120 or as prerequisite(s).

MAR 210 Marine Life through Time 4 Credits

Survey of the important developments in marine life over the last three billion years from the Pre-Cambrian evolution of one-celled organisms, through the Cambrian explosion of complex marine invertebrate life and subsequent diversification of backboned organisms in the Ordovician time, to the colonization of marginal marine and freshwater habitats in the Silurian-Devonian geological periods, and ultimately to extinctions during global crises of the late Devonian, Permian, Triassic, Cretaceous, and Pleistocene time intervals. The emphasis is on evolutionary adaptive breakthroughs within each phylum, particularly the significant morphological and anatomical innovations, and the subsequent radiation of these higher taxa into new habitats and niches through geologic time. Three hours of lecture and one three-hour lab per week.

Prerequisite(s): GEO 100 & GEO 102; or GEO 113 & GEO 102 (can be signed in to take 102 with 113); or BIO 115; or BIO 116; or permission of instructor.

MAR 210L Marine Life through Time Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course. **Corequisite(s):** MAR 210.

Prerequisite(s): GEO 100 & GEO 102; or GEO 113 & GEO 102 (can be signed in to take 102 with 113); or BIO 115; or BIO 116; or permission of instructor.

MAR 290 Directed Research and Study in Marine Sciences 1-4 Credits

Provides an opportunity for freshman and sophomore students to gain hands-on research experience in the marine sciences. This is an individual program of study and each student will work with a selected faculty member on a topic of mutual interest. The course consists of a combination of project meetings, supervised research, and guided readings. The focus will be on formulating research questions, designing and conducting experiments, collecting the necessary data, reviewing the scientific literature as it relates to each student's research topic in a weekly meetings with the instructor, and communicating the findings by writing a final project report.

MAR 300 Introduction to Field Marine Science 4 Credits

In this two-week field course, students will explore various topics in marine science through practical, hands-on, inquiry-based exercises and activities. The course will focus on the biological, geological, chemical, and physical processes that influence diverse marine flora and fauna found in selected marine environments, emphasizing shallow subtidal and intertidal environments such as coral reefs, sandy beaches, turtle grass beds, rocky intertidal pools, coastal wetlands, mangrove swamps, etc. Topics will be examined using field team exercises, a group mapping project, and individual research projects. Activities will help students develop their skills in research, use of field and laboratory equipment, computer analysis of data, and scientific writing, along with gaining content knowledge about the components and processes of environments studied. The course is taught at an appropriate marine field station at a U.S. or international location. Field portion of course is completed during the summer. Additional travel costs vary, depending on location.

Prerequisite(s): BIO 115 or 116 or any 200 or higher level lab science class; and MAR 120; and permission of instructor.

MAR 325 Marine Vertebrates 4 Credits

A survey of the biology of marine vertebrate animals, including fish (jawless fish, sharks, rays, and bony fish), reptiles (sea turtles and sea snakes), sea birds, and mammals (manatees, seals, and whales). The evolution, physiology, natural history, ecological relationships, and human interactions of these groups are emphasized. Three hours of lecture and one three-hour lab per week. Field trips may be required. **Prerequisite(s):** BIO 272 and BIO 272L.

Corequisite(s): MAR 325L.

MAR 325L Marine Vertebrates Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): MAR 325.

MAR 340 Marine Processes and Environments: Seminar 3 Credits

This course is designed as a seminar course. Therefore, students will learn to lead class discussions, to analyze and critique peer-reviewed journal articles, and to enhance their presentation skills. Students will interpret graphical, spatial, and numerical data to support their positions. Content will emphasize the interactions among marine processes, biological features, and geologic landforms.

Prerequisite(s): MAR 120 or GEO 100; GEO 306.

MAR 360 Plankton Ecology 4 Credits

Examines the diversity, physiology, and ecology of marine phytoplankton and zooplankton. Students will survey the dominant plankton groups, their distribution, nutritional requirements, growth kinetics, and behavior. Planktonic predator/prey interactions and food web dynamics will be discussed. Students will also examine the interdisciplinary nature and role of plankton in biogeochemical cycles. Three hours of lecture and one three-hour lab per week. Weekend field trips may be required. **Prerequisite(s):** MAR 120 and MAR 121; or BIO 116.

Corequisite(s): MAR 360L.

MAR 360L Plankton Ecology Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): MAR 360.

MAR 380 The Learning and Teaching of Marine Science 4 Credits

This field-based course provides a practical experience in integrating marine science with pedagogical concepts. Students will use scientific methodology to explain marine ecosystems through specially designed, inquiry-based exercises. During these activities, students will address the process of applying college-level content to their own classroom settings, considering national and state standards. Hands-on, field-based exercises will provide experience with a diversity of marine habitats and the biological, geological, hydrological, and physical processes that influence them. Visited habitats can include rocky intertidal, salt marsh, tidal flat, beach and channel sand bars. As a result, students will develop field and laboratory skills in marine science and use them in designing materials for their own classroom use.

MAR 401 Marine Ecology 4 Credits

The purpose of this course is to introduce students to fundamental principles in ecology, as it relates to marine systems. Topics include the marine environment and its influence on the organisms living there; biodiversity and speciation; factors regulating population dynamics in marine systems; larval and fisheries ecology; species interactions such as predation, competition, and symbiosis; factors regulating productivity and energy flow in marine systems; and marine conservation. Hands-on laboratory exercises will provide students with the opportunity to design and conduct experiments related to marine ecology, and to collect, analyze, and interpret data from those experiments. Ecosystem modeling will also be introduced. Three hours of lecture and one three-hour lab per week. Weekend field trips may be introduced. **Prerequisite(s):** BIO 272, BIO 272L.

Corequisite(s): MAR 401L.

MAR 401L Marine Ecology Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): MAR 401.

MAR 410 Physical Oceanography 3 Credits

Introduction to the physical aspects and processes of the oceans and their influence on marine ecosystems and Earth processes. Topics include distribution of salinity and water temperature and their effect on water movement, the oceanic heat budget, atmospheric and oceanic interactions, ocean currents including surface and deep water circulation, waves, tides, and medium- to small-scale circulation features. Throughout the course, emphasis is placed on how these physical processes affect the biology and chemistry of the ocean. Three hours of lecture per week. Weekend field trips may be required.

Prerequisite(s): MAR 120.

MAR 480 Senior Thesis 3 Credits

A senior thesis is optional for marine sciences majors. However, a senior thesis is required for eligibility to graduate with honors in marine sciences. The topic for investigation will be chosen by the student in consultation with the faculty of the Department of Geological, Environmental, and Marine Sciences. The student must initiate consideration of a proposal to the Department. The proposal must contain a discussion of the proposed project and a timetable to be followed in the study. A departmental committee consisting of a major and minor advisor will evaluate the written paper submitted at the conclusion of the study or other approved venue. An oral presentation before the department at the conclusion of the semester in which the study is completed is required. Proposals must be submitted in final form no later than the end of the ninth week of the semester prior to the semester in which the study is undertaken.

Prerequisite(s): senior standing in the marine sciences major and permission of department chair.

MAR 490 Independent Study: Research and Creative Expression 1-4 Credits

Immerses the student in field or laboratory research. The student learns to organize material, use the literature, make precise measurements, and obtain reproducible data. If possible, the student will publish the results or present them at a scientific meeting.

MAR 491 Internship in Marine Sciences 1-4 Credits

A supervised work experience in an approved organization where qualified students gain real-world knowledge and utilize their academic training in a professional environment. Placements may be in private, public, non-profit, or governmental organizations. These can include consulting firms, regulatory agencies, advocacy groups, and educational or research institutions. Normally, 50 hours of internship per credit is required. A mutually agreed upon method of evaluation will be formalized prior to the approval of the internship by the sponsoring faculty and could include a term paper or project report and a poster presentation.

Prerequisite(s): 2.5 GPA and permission of instructor.

BIO 115 Principles of Biology I 4 Credits

An introductory biology course focusing on major themes of biology: what is life?; Cells as fundamental structure and functional unit of life; information transmission, storage and retrieval; Diversity and unity of life explained by evolution. Three hours of lecture and one three-hour lab per week.

Corequisite(s): BIO 115L.

BIO 115L Principles of Biology I Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): BIO 115.

BIO 116 Principles of Biology II 4 Credits

An introductory biology course focusing on major themes of biology: Energy and matter to carry out life's essential functions; Interdependent relationships characterize biological systems (homeostasis, growth & development); Behavior of living things; Ecology and the environment. Three hours of lecture and one three-hour lab per week.

Corequisite(s): BIO 116L.

BIO 116L Principles of Biology II Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): BIO 116.

BIO 272 Intro to Marine Biology 4 Credits

Introduces students to the study of marine environments, emphasizing the diversity, ecology, and physiology of marine animals, algae, and plants. Aspects of the human impact on marine environments are also discussed. Prerequisite(s): BIO 115 or BIO 116 or BNS 118 and grade of "C" or better.

Corequisite(s): BIO 272L.

BIO 272L Marine Biology Laboratory 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): BIO 272.

BIO 372 Behavior of Marine Organisms: Evolutionary Approach 4 Credits

An examination of the underlying mechanisms and evolutionary causes of behavior, including habitat use, feeding, and mate choice, particularly in marine organisms. The laboratory will involve collecting, analyzing and interpreting field data and performing experiments in the lab using a variety of marine organisms including fish and crabs. Three hours of lecture and one three-hour lab per week. Some full-day field trips (usually on a weekend) are required. Prerequisite(s): BIO 115, BIO 116 with a grade of C or better in each course.

Corequisite(s): BIO 372L.

BIO 372L Behavior of Marine Organisms: Evolutionary Approach Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): BIO 372.

GEO 100 Earth Systems Science 3 Credits

Investigates the major global processes that occur on Earth. These processes can be grouped into four major systems: atmosphere, hydrosphere, lithosphere, and cosmosphere. Each system interacts with and affects the other systems creating, in a sense, a single Earth process. With this approach, the student will view the Earth as a whole, and understand that the many seemingly separate components that make up this planet are, in fact, a set of interacting processes, that operate in cycles through time, within a single global system. Three hours of lecture per week. This course counts towards the fulfillment of the Disciplinary Perspectives element of the CLAS general education curriculum.

GEO 102 Earth Materials and Processes Lab 1 Credits

This lab course introduces students to the origin, identification, and significance of geologic materials, processes, and landforms. Hands-on experiences with mineral and rock specimens, topographic and geologic maps, and GPS and other data collection techniques are emphasized, along with field trip and in-lab observations, measurements, and interpretations. One three-hour lab per week.

Prerequisite(s): concurrent enrollment in, or prior completion of, GEO 100 or GEO 113 is required.

GEO 306 Sedimentology and Stratigraphy 4 Credits

The principles of weathering, erosion, transportation, and deposition of sediment are the focus of this course. Sediment characteristics are examined to identify the processes involved in transporting grains and the specific environment in which the grains were deposited. Students will learn how to collect, analyze, and interpret sedimentary data and how to interpret surface and subsurface stratigraphic data using various techniques, such as lithostratigraphic, biostratigraphic, and geophysical, correlations. Field trips will expose students to different sedimentary environments and provide opportunities for students to learn how to conduct fieldwork. Three hours of lecture and one three-hour lab per week. Weekend field trips may be required. Prerequisite(s): GEO 100.

Corequisite(s): GEO 306L.

GEO 306L Sedimentology and Stratigraphy Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): GEO 306.

ENV 200 Statistical and Computer Applications in the Natural Sciences 4 Credits

This course introduces important statistical concepts, their application, and the usage of computer technology relevant to biological, environmental, geological, and marine problems. Students will learn various graphical and statistical techniques and how to execute them on personal computers. The curriculum emphasizes the integrated nature of these techniques and their importance to meaningful data evaluation and representation. Laboratory exercises are designed to emphasize useful solutions to problems found in many scientific disciplines using computer-based methodologies. Three hours of lecture and one three-hour lab per week.

Corequisite(s): ENV 200L.

ENV 200L Statistical and Computer Applications in the Natural Sciences Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): ENV 200.

ENV 205 Introduction to Geographic Information Systems 3 Credits

This course introduces the computer-based concepts and skills of Geographic Information Systems (GIS). It covers the basic GIS concepts, such as map characteristics and projections, spatial data models and analysis, and relational databases. It explores data sources, data quality, and metadata, as well as implementation and management of specific GIS projects. Hands-on experience with ArcGIS software is provided through a series of student exercises completed throughout the semester. Students will also be taught how to process both vector and raster data using ArcGIS software. The course is relevant for students from numerous disciplines in the natural sciences, social sciences, and business, which require the analysis and graphical representation of spatial data. Three hours of lecture per week.

ENV 320 Global Biogeochemistry 4 Credits

This course introduces students to global biogeochemical processes in the earth system and their influences on marine and terrestrial ecosystems. With a focus on systems thinking and interdisciplinary science, students will learn about the interactions of the biosphere, lithosphere, hydrosphere and atmosphere through elemental cycling and energy transfers. The course extends from the origin of our planet to the modern earth system and considers the anthropogenic impacts of climate change and pollution on humans and other species. Students will analyze scientific data with examples in regulatory and research settings. Students will also gain first-hand experience with field methods including sampling ocean and freshwater using various techniques and equipment and interpreting chemical data. Field trips may be required for this course. Course

Prerequisites: GEO 100 or GEO 113; GEO 102; CHE 120 & 121.

ENV 320L Global Biogeochemistry Lab 0 Credits

This course introduces students to global biogeochemical processes in the earth system and their influences on marine and terrestrial ecosystems. With a focus on systems thinking and interdisciplinary science, students will learn about the interactions of the biosphere, lithosphere, hydrosphere and atmosphere through elemental cycling and energy transfers. The course extends from the origin of our planet to the modern earth system and considers the anthropogenic impacts of climate change and pollution on humans and other species. Students will analyze scientific data with examples in regulatory and research settings. Students will also gain first-hand experience with field methods including sampling ocean and freshwater using various techniques and equipment and interpreting chemical data. Field trips may be required for this course. Course

Prerequisites: GEO 100 or GEO 113; GEO 102; CHE 120 & 121.

CHE 120 Principles of Chemistry 3 Credits

For students who have successfully completed one year of high school chemistry. This systematic study of the fundamental principles and concepts of chemistry covers atomic structure, bonding, stoichiometric relationships, including solution and oxidation-reduction reactions, and molecular structure. Three hours of lecture per week. Prerequisite(s): High school chemistry or CHE 100 is recommended before taking this course.

Corequisite(s): CHE 121.

CHE 121 Principles of Chemistry Lab 1 Credits

For students concurrently taking CHE 120. Experiments involve gravimetric, volumetric, and spectrophotometric quantitative analysis. One three-hour lab per week. Fall.

CHE 122 Intro to Chemical Systems 3 Credits

A continuation of CHE 120. For students majoring in the sciences but may be taken by others. Chemical systems in which the study of kinetics, thermodynamics, equilibrium, and radiochemistry are emphasized. Three hours of lecture per week. Prerequisite(s): CHE 120, MTH 105 or higher.

Corequisite(s): CHE 123.

CHE 123 Quantitative Methods Lab 1 Credits

Usually taken concurrently with CHE 122. Primarily for students majoring in the sciences. A number of quantitative classical and instrumental methods of analysis are used to determine thermodynamic properties and reaction mechanisms. One three-hour lab per week. Prerequisite(s): CHE 121.

Corequisite(s): CHE 122.

PHY 100 Principles of Physics I 3 Credits

Introductory noncalculus physics with applications for pre-professional, biology, and geological, environmental and marine sciences majors. Classical mechanics, energy, mechanical waves, fluid statics and dynamics, thermodynamics. Elements of modern physics are interwoven with those of classical physics from the beginning. Not open to chemistry, physics, or mathematics majors. Three hours of lecture per week. Prerequisite(s): MTH 105, MTH 210, MTH 211 or MTH 212.

Corequisite(s): PHY 100L.

PHY 100L Principles of Physics I Lab 1 Credits

For students concurrently taking PHY 100. One three-hour lab per week.

Corequisite(s): PHY 100.