

INTEGRATED SCIENCES AND MATH

Program Overview

The Integrated Sciences and Math major (ISM) is designed primarily as a second major for students in the College of Education and Human Services (<http://catalog.rider.edu/undergraduate/colleges-schools/education/>) interested in teaching science or math at the middle school level. The program is tailored to meet the New Jersey certification requirements for middle school science or math teachers and to facilitate the timely completion of the dual graduation requirements for education majors in the College of Education and Human Services and the College of Liberal Arts and Sciences. This major is not designed to prepare students for further study in science or math disciplines at the graduate or professional level, or to teach science or math at the high school level. Students who may wish to teach science or math at the high school level should discuss the additional certification requirements needed with their College of Education and Human Services academic advisor.

Curriculum Overview

The Integrated Sciences and Math major is truly interdisciplinary in nature, both in its curriculum and in the faculty who teach it, including teacher education, biology, chemistry, physics, earth sciences and mathematics faculty.

Students may choose from four different program concentrations depending on their particular interest: Life Sciences, Physical Sciences, Earth Sciences, or Mathematics. Coursework will vary depending on which concentration the student decides to take.

Students should plan their courses through consultations with both their ISM and Education academic advisors.

Honors Program in Integrated Sciences and Math

Graduation with honors in Integrated Sciences and Math is awarded in recognition of majors who have demonstrated outstanding academic ability. Enrollment in the program is by invitation of the faculty of the Department of Geological, Environmental, and Marine Sciences (GEMS). Eligibility requirements include a minimum GPA of 3.50 in courses required for the major and the satisfactory completion of a three- or four-credit Independent Research and Study. In addition, an honors candidate must maintain an overall minimum GPA of 3.00.

Degree Offered

- B.A. in Integrated Sciences and Math

Contact

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Program Website: www.rider.edu/gems (<http://www.rider.edu/gems/>)
Associated Department: Department of Geological, Environmental, and Marine Sciences (GEMS)

Related Programs

- Earth and Environmental Sciences (<http://catalog.rider.edu/undergraduate/colleges-schools/liberal-arts-sciences/majors-minors-certificates/earth-environmental-sciences/>)
- Earth Sciences (<http://catalog.rider.edu/undergraduate/colleges-schools/liberal-arts-sciences/majors-minors-certificates/earth-sciences/>)
- Environmental Sciences (<http://catalog.rider.edu/undergraduate/colleges-schools/liberal-arts-sciences/majors-minors-certificates/environmental-sciences/>)
- Environmental Studies (<http://catalog.rider.edu/undergraduate/colleges-schools/liberal-arts-sciences/majors-minors-certificates/environmental-studies/>)
- Geology (<http://catalog.rider.edu/undergraduate/colleges-schools/liberal-arts-sciences/majors-minors-certificates/geosciences/>)
- Marine Sciences (<http://catalog.rider.edu/undergraduate/colleges-schools/liberal-arts-sciences/majors-minors-certificates/marine-sciences/>)
- Education (<http://catalog.rider.edu/undergraduate/colleges-schools/education/>)

Integrated Sciences and Math Major Requirements

(47 - 51 credits)

Code	Title	Credits
CLAS General Education Curriculum		
See CLAS General Education Curriculum Page (http://catalog.rider.edu/undergraduate/colleges-schools/liberal-arts-sciences/general_education_requirements/)		
Required ISM Courses		
ISM 100	Introduction to the Integrated Sciences and Math	4
ISM 410	Seminar in the Integrated Sciences and Math	3
Inquiry-based Science Courses		
Select two courses from two different categories below but not from your area of declared concentration (see Areas of Concentration below):		
Life Sciences		
BIO 110	Life Science: Inquiry Approach	
Earth Sciences		
GEO 100 & GEO 102	Earth Systems Science and Earth Materials and Processes Lab	
MAR 120 & MAR 121	Oceanography and Introductory Oceanography Lab	
Physical Sciences		
CHE 118	Exploration of Chemical Principles	
PHY 105	Matter, Forces, and Energy: A Exploration of Physics Concepts	
or PHY 100 & 100L	Principles of Physics I and Principles of Physics I Lab	
Mathematics Requirement for All ISM Majors:		
MTH 105	Algebra and Trigonometry	4
MTH 210	Calculus I	4
BNS 250	Biostatistics	4
or ENV 200	Statistical and Computer Applications in the Natural Sciences	

Select one of the following: 3-4

MTH 102	Finite Mathematics
MTH 151	Mathematics for Education Majors II
MTH 152	Mathematics for Education Majors III
CSC 140	Discrete Structures
CSC 110	Computer Science I

OR

Select any other math class above MTH 210 (except students planning to take PHY 200 for the physical science concentration must take MTH 211 Calculus II)

Areas of Concentration

Students must select one area of concentration: Earth Sciences, Life Sciences, Physical Sciences or Mathematics.

A. Earth Sciences (18-20 credits)

Required:

GEO 100 & GEO 102	Earth Systems Science and Earth Materials and Processes Lab
MAR 120 & MAR 121	Oceanography and Introductory Oceanography Lab
PHY 180	Astronomy
ENV 220	Weather and Climate Change

Electives: Select 4-6 credits at the 200 level or above from GEO/ENV/MAR courses

B. Life Sciences (20 credits)

Required:

BIO 115 & 115L	Principles of Biology I and Principles of Biology I Lab
BIO 116 & 116L	Principles of Biology II and Principles of Biology II Lab

Electives: select 12 credits of 200 level or higher lab courses; one must be at the 300 level or higher

C. Physical Sciences (20 credits)

Required:

CHE 120 & CHE 121	Principles of Chemistry and Principles of Chemistry Lab
CHE 122 & CHE 123	Intro to Chemical Systems and Quantitative Methods Lab
PHY 200	General Physics I

Students taking PHY 200 for the physical science concentration must take MTH 211 Calculus II for math elective; see Math Courses above

AND

One of the following pairs:

CHE 211 & 211L	Organic Chemistry I and Organic Chemistry I Lab
or BCH 225 & 225L	Introduction to Organic and Biochemistry and Introduction to Organic & Biochemistry Lab

AND

PHY 105	Matter, Forces, and Energy: A Exploration of Physics Concepts
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OR

CHE 118 & PHY 201	Exploration of Chemical Principles and General Physics II
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D. Mathematics (18-20 credits; six courses total)

Important note: Courses taken as part of the Mathematics Requirement for all ISM majors above may not be used to fulfill this requirement.

Required:

MTH 211	Calculus II
MTH 240	Linear Algebra
MTH 315	Modern Geometry

An additional 9-10 credits in upper level MTH courses are required to complete the Mathematics Concentration.

Total Credits 47-51

Concentration Requirements

Select one of the following concentrations:

Life Sciences

Earth Sciences

Physical Sciences

Mathematics

Life Sciences Concentration Requirements

(20 credits)

Code	Title	Credits
BIO 115 & 115L	Principles of Biology I and Principles of Biology I Lab	4
BIO 116 & 116L	Principles of Biology II and Principles of Biology II Lab	4
Twelve credits of 200 or higher level lab courses; one must be 300 or greater level		12
Total Credits		20

Earth Sciences Concentration Requirements

(18-20 credits)

Code	Title	Credits
GEO 100	Earth Systems Science	3
GEO 102	Earth Materials and Processes Lab	1
MAR 120	Oceanography	3
MAR 121	Introductory Oceanography Lab	1
PHY 180	Astronomy	3
ENV 220	Weather and Climate Change	3
Four to six credits at the 200-level or above from GEO/ENV/MAR courses		4-6
Total Credits		18-20

Physical Sciences Concentration Requirements

(20 credits)

Code	Title	Credits
CHE 120	Principles of Chemistry	3
CHE 121	Principles of Chemistry Lab	1
CHE 122	Intro to Chemical Systems	3

CHE 123	Quantitative Methods Lab	1
PHY 200	General Physics I	4
Select one of the following:		8
CHE 211 & PHY 105	Organic Chemistry I and Matter, Forces, and Energy: A Exploration of Physics Concepts (BCH 225 may be substituted for CHE 211)	
CHE 118 & PHY 201	Exploration of Chemical Principles and General Physics II	
Total Credits		20

Mathematics Concentration Requirements

(20 credits)

Code	Title	Credits
MTH 211	Calculus II ¹	4
MTH 212	Calculus III ¹	4
MTH 240	Linear Algebra	3
Three or more upper level Math classes		9
Total Credits		20

¹ MTH 211 and MTH 212 may be used to satisfy the concentration requirement only if not used to satisfy the Mathematics requirements above.

Academic Plans of Study

The following educational plans are provided as a sample only. Rider students who do not declare a major during their freshman year; who change their major; or those who transfer to Rider will 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.

- Earth Science Concentration (p. 5)
- Life Science Concentration (p. 4)
- Mathematics Concentration (p. 4)
- Physical Science Concentration (p. 3)

Physical Science Concentration

Note: Science and Mathematics core requirements are included in the Major.

Course	Title	Credits
Year 1		
Fall Semester		
CMP 120	Seminar in Writing and Rhetoric	3
MTH 102	Finite Mathematics	3
ISM 100	Introduction to the Integrated Sciences and Math	4
HIS 150	World History to 1500	3
Foreign Language ¹		3
Semester Credit Hours		16
Spring Semester		
CMP 125	Seminar in Writing and Research	3

HIS 151	World History Since 1500	3
MTH 105	Algebra and Trigonometry	4
GEO 100	Earth Systems Science	3
GEO 102	Earth Materials and Processes Lab	1
Foreign Language		3
Semester Credit Hours		17

Year 2

Fall Semester

MTH 210	Calculus I	4
CHE 120	Principles of Chemistry	3
CHE 121	Principles of Chemistry Lab	1
Social Perspectives		3
Aesthetic Perspectives: Fine Arts		3
Semester Credit Hours		14

Spring Semester

MTH 212	Calculus III	4
CHE 122	Intro to Chemical Systems	3
CHE 123	Quantitative Methods Lab	1
Philosophical Perspectives		3
Social Perspectives		3
Semester Credit Hours		14

Year 3

Fall Semester

PHY 200	General Physics I	4
PHY 200L	General Physics I Lab	0
ENV 200	Statistical and Computer Applications in the Natural Sciences	4
ENV 200L	Statistical and Computer Applications in the Natural Sciences Lab	0
Aesthetic Perspectives: Literature		3
Elective Course ²		3
Semester Credit Hours		14

Spring Semester

PHY 105	Matter, Forces, and Energy: A Exploration of Physics Concepts	4
PHY 105L	Matter, Forces and Energy Lab	0
CHE 118	Exploration of Chemical Principles	4
CHE 118L	Exploration of Chemical Principles Lab	0
CHE 211	Organic Chemistry I	4
CHE 211L	Organic Chemistry I Lab	0
Two Elective Courses ²		6
Semester Credit Hours		18

Year 4

Fall Semester

ISM 410	Seminar in the Integrated Sciences and Math	3
Four Elective Courses ²		12
Semester Credit Hours		15

Spring Semester

Five Elective Courses ²		15
Semester Credit Hours		15
Total Credit Hours for Graduation		123

¹ For course placement information see <http://www.rider.edu/offices-services/orientation/course-placement> (<http://www.rider.edu/offices-services/orientation/course-placement/>)

² Please note that elective credits may be used to complete requirements in a second major or minor.

Mathematics Concentration

Note: Science and Mathematics core requirements are included in the Major.

Course	Title	Credits
Year 1		
Fall Semester		
CMP 120	Seminar in Writing and Rhetoric	3
MTH 102	Finite Mathematics	3
ISM 100	Introduction to the Integrated Sciences and Math	4
HIS 150	World History to 1500	3
Foreign Language ¹		3
Semester Credit Hours		16

Spring Semester

CMP 125	Seminar in Writing and Research	3
HIS 151	World History Since 1500	3
MTH 105	Algebra and Trigonometry	4
Inquiry-based Science Course		4
Semester Credit Hours		14

Year 2

Fall Semester

MTH 210	Calculus I	4
Mathematics (MTH) Concentration Elective ²		4
Social Perspectives		3
Foreign Language		3
Semester Credit Hours		14

Spring Semester

MTH 211	Calculus II	4
Mathematics (MTH) Concentration Elective ²		4
Philosophical Perspectives		3
Aesthetic Perspectives: Literature		3
One Elective Course ²		3
Semester Credit Hours		17

Year 3

Fall Semester

MTH 240	Linear Algebra	3
ENV 200	Statistical and Computer Applications in the Natural Sciences	4
ENV 200L	Statistical and Computer Applications in the Natural Sciences Lab	0
Social Perspectives		3
Aesthetic Perspectives: Fine Arts		3
One Elective Course ²		3
Semester Credit Hours		16

Spring Semester

MTH 315	Modern Geometry	3
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Mathematics (MTH) Concentration Elective	3	
Two elective Courses ²	6	
Inquiry-based Science Course	4	
Semester Credit Hours		16

Year 4

Fall Semester

ISM 410	Seminar in the Integrated Sciences and Math	3
Four Elective Courses ²		12
Semester Credit Hours		15

Spring Semester

Five Elective Courses ²		15
Semester Credit Hours		15
Total Credit Hours for Graduation		123

¹ For course placement information see <http://www.rider.edu/offices-services/orientation/course-placement> (<http://www.rider.edu/offices-services/orientation/course-placement/>)

² Please note that elective credits may be used to complete requirements in a second major or minor.

Life Science Concentration

Note: Science and Mathematics core requirements are included in the Major.

Course	Title	Credits
Year 1		
Fall Semester		
CMP 120	Seminar in Writing and Rhetoric	3
MTH 102	Finite Mathematics	3
ISM 100	Introduction to the Integrated Sciences and Math	4
HIS 150	World History to 1500	3
Foreign Language ¹		3
Semester Credit Hours		16

Spring Semester

CMP 125	Seminar in Writing and Research	3
HIS 151	World History Since 1500	3
MTH 105	Algebra and Trigonometry	4
Inquiry-based Science Course		4
Semester Credit Hours		14

Year 2

Fall Semester

MTH 210	Calculus I	4
BIO 115	Principles of Biology I	4
BIO 115L	Principles of Biology I Lab	0
Social Perspectives		3
Foreign Language		3
One Elective Course ²		3
Semester Credit Hours		17

Spring Semester

BIO 116	Principles of Biology II	4
MTH 211	Calculus II	4
BIO 116L	Principles of Biology II Lab	0

Philosophical Perspectives	3
Aesthetic Perspectives: Literature	3
Semester Credit Hours	14
Year 3	
Fall Semester	
Inquiry-based Science Course	4
Life Science Concentration Elective ²	4
Social Perspectives	3
Aesthetic Perspectives: Fine Arts	3
Semester Credit Hours	14
Spring Semester	
BNS 250 Biostatistics	4
BNS 250L Biostatistics Lab	0
Life Science Concentration Elective ²	4
Three Elective Course ²	9
Semester Credit Hours	17
Year 4	
Fall Semester	
ISM 410 Seminar in the Integrated Sciences and Math	3
Life Science Concentration Elective ²	4
Three Elective Courses ²	9
Semester Credit Hours	16
Spring Semester	
Five Elective Courses ²	15
Semester Credit Hours	15
Total Credit Hours for Graduation	123

¹ For course placement information see <http://www.rider.edu/offices-services/orientation/course-placement> (<http://www.rider.edu/offices-services/orientation/course-placement/>)

² Please note that elective credits may be used to complete requirements in a second major or minor.

Earth Science Concentration

Note: Science and Mathematics core requirements are included in the Major.

Course	Title	Credits
Year 1		
Fall Semester		
CMP 120	Seminar in Writing and Rhetoric	3
ISM 100	Introduction to the Integrated Sciences and Math	4
MTH 102	Finite Mathematics	3
HIS 150	World History to 1500	3
Foreign Language ¹		3
Semester Credit Hours		16
Spring Semester		
CMP 125	Seminar in Writing and Research	3
HIS 151	World History Since 1500	3
MTH 105	Algebra and Trigonometry	4
GEO 100	Earth Systems Science	3

GEO 102	Earth Materials and Processes Lab	1
Semester Credit Hours		14

Year 2

Fall Semester

MTH 210	Calculus I	4
Inquiry-based Science Course		4
Foreign Language		3
Aesthetic Perspectives: Fine Arts		3
Semester Credit Hours		14

Spring Semester

ENV 220	Weather and Climate Change	3
Earth Sciences Concentration Elective ²		4
One Elective Courses ²		3
Philosophical Perspectives		3
Social Perspectives		3
Semester Credit Hours		16

Year 3

Fall Semester

MAR 120	Oceanography	3
MAR 121	Introductory Oceanography Lab	1
Earth Science Concentration Elective ²		4
Aesthetic Perspectives: Literature		3
Inquiry-based Science Course ²		4
Semester Credit Hours		15

Spring Semester

PHY 180	Astronomy	3
Three Elective Courses ²		9
Social Perspectives		3
Semester Credit Hours		15

Summer Semester

MAR 380	The Learning and Teaching of Marine Science	4
Semester Credit Hours		4

Year 4

Fall Semester

ENV 200	Statistical and Computer Applications in the Natural Sciences	4
ENV 200L	Statistical and Computer Applications in the Natural Sciences Lab	0
ISM 410	Seminar in the Integrated Sciences and Math	3
Three Elective Courses ²		9
Semester Credit Hours		16

Spring Semester

Five Elective Courses ²		15
Semester Credit Hours		15
Total Credit Hours for Graduation		125

¹ For course placement information see <http://www.rider.edu/offices-services/orientation/course-placement> (<http://www.rider.edu/offices-services/orientation/course-placement/>)

² Please note that elective credits may be used to complete requirements in a second major or minor.

Courses and Descriptions

ISM 100 Introduction to the Integrated Sciences and Math 4 Credits

Traditional lectures and laboratory experiences are blended to encourage students to begin asking questions and designing experiments to learn about the physical, life, and Earth sciences. This is the entry-level course for the integrated sciences and math major, though it is open to all students who want to actively explore the nature of science. Two three-hour combined lab/lecture sessions per week.

ISM 410 Seminar in the Integrated Sciences and Math 3 Credits

As a senior seminar course, class discussion, presentation, and participation will be emphasized. Science topics covered will extend beyond the range of a single science discipline. Students will evaluate articles (from popular science magazines, newspapers, etc.) to discern the connections among various scientific disciplines. Students will present written critiques of the articles focusing on the proper use of the scientific method, data analysis techniques (e.g., statistics, mathematics, etc.), and on the plausibility of the interpretations. Students will also present a semester-long project (both written and oral) that focuses on the connections among disciplines of a scientific issue.

Prerequisite(s): ISM 100, senior standing, or permission of instructor.

BIO 110 Life Science: Inquiry Approach 4 Credits

An introductory course for non-science majors in which students develop an understanding of biological evolution, the molecular basis of heredity, the cell, matter, energy and organization in living systems, and the interdependence of organisms. In addition, students will develop an understanding of science as a human endeavor, the nature of scientific knowledge, and historical perspectives. Through investigative activities, students will develop an understanding about scientific inquiry and develop abilities necessary to do scientific inquiry. Three hours of lecture and one three-hour lab per week.

Corequisite(s): BIO 110L.

BIO 110L Life Science: Inquiry Approach Lab 0 Credits

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

Corequisite(s): BIO 110.

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 215 Medical Microbiology 4 Credits

Biology of prokaryotes of medical interest with emphasis placed on diversity and host-pathogen interaction. Current research literature will be covered and presented by students. Methods of microbial identification are introduced in the laboratory and applied in the identification of mock clinical isolates. Three hours of lecture and one three-hour lab per week.

Prerequisite(s): BIO 115, BIO 116 with a grade of C or better in each course,

Corequisite(s): BIO 215L.

BIO 215L Microbiology Lab 0 Credits

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

Corequisite(s): BIO 215.

BIO 260 Principles of Biology: Evolution, Diversity, and Biology of Cells 4 Credits

Lectures and labs focus on basic cell biology. Cell diversity and function, genetics and biotechnology are emphasized. Three hours of lecture and one three-hour lab per week. **Prerequisite(s):** BIO 115/115L and BIO 116/116L or BIO 115, BIO 117, (BNS 118 or BNS 275).

Corequisite(s): BIO 260L.

BIO 260L Principle of Biology: Cells Lab 0 Credits

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

Corequisite(s): BIO 260.

BIO 265 Genetics 4 Credits

A comprehensive course focusing on molecular, Mendelian, and population genetics. Topics covered will include molecular advances in the study of genetics, including genomics and bioinformatics; evolution and the effects of genetic mutations; the application of population genetics to forensic science; genetic problem solving, including genetic crosses and statistical analysis; and regulation of gene expression. The laboratory for this course will introduce students to commonly used genetic model organisms and basic molecular biology techniques. Three hours of lecture and one three-hour lab per week. **Prerequisite(s):** BIO 115, BIO 116 and (BIO 260 or BIO 117) with a grade of C or better in each course.

Corequisite(s): BIO 265L.

BIO 265L Genetics Lab 0 Credits

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

Corequisite(s): BIO 265.

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 305 Vertebrate Physiology 4 Credits

Study of the principles and mechanisms of mammalian physiology. Topics include the nervous system, muscle physiology, cardiovascular physiology, respiration, gastrointestinal activity, renal function, and endocrine physiology. Lectures and laboratory exercises emphasize homeostatic mechanisms and organ-system interactions. Three hours of lecture and one three-hour lab per week. Prerequisite(s): BIO 115, BIO 116 with a grade of C or better in each course.

Corequisite(s): BIO 305L.

BIO 305L Vertebrate Physiology Lab 0 Credits

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

Corequisite(s): BIO 305.

BIO 321 Microbiology 4 Credits

An introduction to the discipline of microbiology, with an emphasis on the biology of prokaryotes found in all the natural realms of our environment, including the oceans, soil, atmosphere, and extreme habitats. Emphasis will be placed on microbial diversity, fundamental microbial processes, and the continual interaction between microbes and the natural environment. Classical and modern methods of identification are introduced in the laboratory. Three hours of lecture and one three-hour lab per week. Some field trips are required. Prerequisite(s): BIO 115, BIO 116 with a grade of C or better in each course.

Corequisite(s): BIO 321L.

BIO 321L Microbiology Lab 0 Credits

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

Corequisite(s): BIO 321.

BIO 340 Evolutionary Biology 4 Credits

Where did we come from? This course will explore the generation of biological diversity on earth. Course topics will include: the history of evolutionary thought; the different lines of evidence and fields of inquiry that bear on our understanding of evolution; selection vs. random changes in populations over time; speciation; extinction; the molecular basis of evolution; and evolutionary developmental biology. Three hours of lecture and one three-hour lab per week. Prerequisite(s): BIO 115, BIO 116, BIO260 with a grade of C or better in each course Co-requisite(s): BIO 340L.

BIO 340L Evolutionary Biology Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course. Corequisite(s): BIO 340.

BIO 350 General Ecology 4 Credits

An investigation of the processes that regulate the distribution of plants and animals throughout the biosphere. Relationships among species and their interactions with the environment are stressed. Quantitative analyses of experimental results and current research in basic and applied ecology are discussed. Laboratory activities explore conceptual models using both field activities and computer simulations. Three hours of lecture and one three-hour lab per week. One Saturday field trip (laboratory time will be adjusted accordingly). Prerequisite(s): BIO 115, BIO 116, with a grade of "C" or better in each course.

Corequisite(s): BIO 350L.

BIO 350L General Ecology Lab 0 Credits

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

Corequisite(s): BIO 350.

BIO 370 Immunology 4 Credits

An introduction to the cells and molecules of the immune system with emphasis on recent advances. Topics include AIDS, autoimmunity, transplantation, and cancer. Readings from current journals will be discussed and presented by students. The laboratory will introduce current research techniques and then apply these to a research problem with critical analyses of the data generated. Three hours of lecture and one three-hour lab per week. Prerequisite(s): BIO 115, BIO 116 and (BIO 260 or BIO 117) with a grade of C or better in each course.

Corequisite(s): BIO 370L.

BIO 370L Immunology Lab 0 Credits

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

Corequisite(s): BIO 370.

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.

BNS 310 Neurobiology 4 Credits

A lecture-laboratory course investigating the structure and function of the nervous system. Lecture topics include organization of the nervous system, neuroanatomy, neurophysiology, neurochemistry, physiology of sensory systems, biological aspects of nervous system diseases, and behavior. Laboratory exercises include study of anatomy of the nervous system, nerve cell recording, modern neuroanatomical techniques, and the neural basis of animal behavior. Three hours of lecture and one three-hour lab per week. Prerequisite(s): BIO 115, BIO 116 with a grade of C or better in each course. Corequisite(s): BNS 310L.

BNS 310L Neurobiology Lab 0 Credits

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

Corequisite(s): BNS 310.

BNS 375 Neuroethology: Circuits of Behavior 4 Credits

Neuroethology is the study of the neural and physiological basis of animal behavior. This course focuses on the specific behavioral problems faced by animals in their natural habitats, and the ways in which their nervous systems solve these problems. The mechanisms that underlie complex behaviors such as spatial orientation and navigation, escape mechanisms, and animal communication will be examined, as well as the extraordinary sensory adaptation of organisms to their environments (e.g., echolocation, electroreception, and magnetic reception). The neural control of motor programs and temporally-patterned behaviors will be studied in simpler neuronal systems. Finally, recent cellular and molecular approaches to the study of behavior will be addressed. Three hours of lecture and one three-hour lab per week. Prerequisite(s): BIO 115, BIO 116 with a grade of C or better in each course.

Corequisite(s): BNS 375L.

BNS 375L Neuroethology Lab 0 Credits

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

Corequisite(s): BNS 375.

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.

CHE 118 Exploration of Chemical Principles 4 Credits

A one-semester introduction to the principles of chemical sciences. Students will utilize inquiry-based learning methods to examine contextual problems as a means to explore introductory models and concepts of chemistry. Students will also gain an understanding of how scientific models are used to explain experimental observations. The laboratory component of this course is designed to provide students with an experimental context within which to develop some of the models described in the classroom. Three hours of lecture and one three-hour lab per week.

CHE 118L Exploration of Chemical Principles Lab 0 Credits

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

Corequisite(s): CHE 118.

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.

CHE 211 Organic Chemistry I 4 Credits

The structure, chemical properties, and methods of preparation of the more important classes of carbon compounds are studied, with an emphasis on the relationship of structure, stereochemistry, and conformation to chemical reactivity. The preparation and reactivity of organic functional groups is introduced. The use of infrared and nuclear magnetic resonance spectroscopy, and mass spectrometry for elucidating structures of organic molecules is discussed. Three hours of lecture and one three-hour lab per week. Prerequisite(s): CHE 120, CHE 121.

Corequisite(s): CHE 211L.

CHE 211L Organic Chemistry I Lab 0 Credits

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

Corequisite(s): CHE 211.

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 220 Weather and Climate Change 3 Credits

This course introduces students to the concepts of weather and climate change. These concepts frame a continuum from short-term or daily changes in the atmosphere (meteorology) to those changes averaged over much longer periods of time (climatology). Students will learn the fundamentals of weather forecasting, the causes of natural variation in the Earth's climate, and the impact of human actions on the Earth's climate. Connections will be drawn to other current issues in the Earth system, including land use change, biodiversity, and pollution. Three hours of lecture per week.

Prerequisite(s): GEO 100 or permission of instructor.

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 407 Hydrology and Water Resources 4 Credits

This course introduces the principles that govern both surface water and groundwater flows that have applications to societal water needs. Surface water topics cover the basics of the hydrologic cycle, the processes of precipitation, evapotranspiration, runoff, and infiltration, and various factors affecting water supply and water quality issues in a modern watershed. Groundwater topics examine the principles that govern flow through a porous medium and the basics of well hydraulics under different pumping conditions that community development requires. Laboratory exercises will give students hands-on experience with the delineation of watersheds, analysis of precipitation data, and flow contaminant transport modeling. The field portion of the laboratory includes runoff and stream discharge measurements, as well as hydraulic conductivity estimations from both slug and pumping tests. Three hours of lecture and one three-hour lab per week. Prerequisite(s): GEO 100 or GEO 113, GEO 102, and MTH 105.

Corequisite(s): GEO 407L.

GEO 407L Hydrology and Water Resources Lab 0 Credits

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

Corequisite(s): GEO 407.

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.

MTH 102 Finite Mathematics 3 Credits

This mathematically rigorous course begins with a review of the rational numbers, repeating decimals, irrational numbers and non-repeating decimals. The elementary theory of sets is discussed with applications to surveys and data mining. This is followed by a discussion of the cardinality of infinite sets. An introduction to elementary number theory includes various applications. The Cartesian plane and the idea of a function and its graph are introduced with applications. Counting theory then precedes an elementary discussion of probability.

MTH 105 Algebra and Trigonometry 4 Credits

The course is an in depth and rigorous study of functions and graphs, equations and inequalities, polynomial and rational functions, exponential, and logarithmic functions, basic trigonometric functions and their inverses, trigonometric identities.

Prerequisite(s): A mathematics SAT score of 570, departmental placement or MTH 100 with a grade of C or higher.

MTH 210 Calculus I 4 Credits

Introduces analytic geometry, functions, limits, and derivatives; differentiation of algebraic and trigonometric functions, curve sketching, maxima and minima, and higher derivatives.

Prerequisite(s): Math SAT 650 or higher or Math ACT score of 28 or higher or MTH 105 with a grade of C or higher.

MTH 211 Calculus II 4 Credits

The definite integral, differentiation of transcendental functions, methods of integration and approximate integration, determination of area, volume, and surface area.

Prerequisite(s): MTH 210 with a grade of C or higher.

MTH 212 Calculus III 4 Credits

Infinite series; functions of two and three variables, vectors and tangent planes, partial derivatives, multiple integrals, determination of volume and density.

Prerequisite(s): MTH 211 with a grade of C or higher.

MTH 230 Discrete Mathematics 4 Credits

An introduction to topics in Discrete Mathematics. This course covers methods of proof, induction and recursion, and other topics in discrete mathematics. Topics may include graph theory, trees, and symmetry groups.

Prerequisite(s): MTH 102, MTH 105 or MTH 210.

MTH 240 Linear Algebra 3 Credits

Systems of linear equations; vector spaces; linear independence; determinants; orthogonality; linear maps; eigenvectors.

Prerequisite(s): MTH 210 or as corequisite; sophomore standing; or permission of instructor.

MTH 250 Differential Equations 3 Credits

First order differential equations, separable and exact; integrating factors; second order linear differential equations; series solutions of second order linear differential equations; higher order equations; existence and uniqueness theorems; systems of linear differential equations.

Prerequisite(s): MTH 240, MTH 211.

Corequisite(s): MTH 212 or as prerequisite.

MTH 308 Advanced Calculus 3 Credits

Vectors, gradients, and directional derivatives, Lagrange multipliers, Taylor's theorem, multiple integrals, change of variables, line and surface integrals, Stokes' theorem.

Prerequisite(s): "B" average in MTH 210 and MTH 211; MTH 212, MTH 240.

MTH 315 Modern Geometry 3 Credits

Covers geometry from a modern point of view, with emphasis on non-Euclidean geometry, particularly projective geometry.

Prerequisite(s): MTH 211, MTH 240.

MTH 340 Probability & Statistical Analysis I 3 Credits

Theory of sets and probability; discrete and continuous random variables and probability distributions. Emphasizes foundations and utilizes the techniques of the calculus.

Prerequisite(s): MTH 212 or MSD 111.

MTH 341 Probability & Statistical Analysis II 3 Credits

Continuation of MTH 340. Foundations of mathematical statistics: normal distributions, estimation, confidence intervals and hypothesis testing; topics chosen from student's t-test, chi-square tests, analysis of variance and regression analysis. Emphasizes foundations and utilizes the techniques of the calculus.

Prerequisite: MTH 340. Spring.

MTH 401 Modern Algebra 3 Credits

Provides an introduction to modern abstract algebra. It emphasizes the axiomatic method to analyze the major algebraic systems. The instructor will choose the topics to be studied from among the following algebraic structures: integral domains, fields, complete ordered fields, groups, polynomials, rings, ideals and modules.

Prerequisite(s): MTH 240.

MTH 410 Complex Analysis 3 Credits

Analytic functions, conformal mapping, power series, Cauchy's theorem, calculus of residues.

Prerequisite(s): MTH 308.

MTH 420 Number Theory 3 Credits

Covers topics including divisibility theory, the prime numbers, the theories of congruences and of quadratic reciprocity, and Fermat's Last Theorem. Other topics may also include applications to cryptography, Pell's equations, continued fractions, and the theory of partitions.

Prerequisite(s): MTH 240 or permission of instructor.

MTH 430 Introduction to Topology 3 Credits

A comprehensive introduction to elementary topology. The concepts of topological spaces and metric spaces will be introduced. Connectedness, compactness and properties of subsets of the real numbers rooted in topology will also be considered. The quotient topology will be used to construct surfaces as identification spaces, and tools will be developed to distinguish one surface from another.

Prerequisite(s): MTH 212.

MTH 440 Real Analysis 3 Credits

Covers the theory of sets, the real number system and its properties, convergence of sequences and series of numbers and functions, and the theory of integration, including: measure theory, the Riemann integral, and introduction to the Lebesgue theory of integration.

Prerequisite(s): MTH 308 or as corequisite.

PHY 105 Matter, Forces, and Energy: A Exploration of Physics Concepts 4 Credits

An introduction to the basic principles of physics focusing on the concepts of matter, force, and energy. The course will study, in depth, simple physical systems chosen to emphasize the interconnection of these three basic concepts. It will explore the behavior of these simple physical systems using directed group exercises coordinated with hands-on laboratory activities. One three-hour lecture and one three-hour lab per week.

PHY 105L Matter, Forces and Energy Lab 0 Credits**PHY 200 General Physics I 4 Credits**

Introductory classical physics; Newtonian mechanics, including the conservation laws, wave motion, gravity, thermodynamics. Three hours of lecture and one three-hour lab per week. Prerequisite(s): MTH 210 or concurrent enrollment

Corequisite(s): PHY 200L.

PHY 200L General Physics I Lab 0 Credits

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

Corequisite(s): PHY 200.

PHY 201 General Physics II 4 Credits

A continuation of the concepts developed in Physics 200. Electricity, electrical circuits, magnetism, Maxwell's equations. Light and optics, including lenses, interference, and diffraction. Three hours of lecture and one three-hour lab per week. Prerequisite(s): PHY 200, MTH 211 or concurrent enrollment.

Corequisite(s): PHY 201L.

PHY 201L General Physics II Lab 0 Credits

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

Corequisite(s): PHY 201.