



COLLEGE OF MARINE AND EARTH STUDIES

UNDERGRADUATE PROGRAMS

- **Geological Sciences**
- **Undergraduate Courses in Marine Studies**
- **Semester-In-Residence**

The College of Marine and Earth Studies offers several courses in marine studies that are open for undergraduate students, research opportunities for undergraduate students, and bachelor's degrees in the Department of Geological Sciences, including a B.S. degree in Environmental Science, offered in cooperation with the Department of Geography and the Department of Biological Sciences. Interdepartmental and double majors are encouraged in undergraduate study.

CMES strives to advance the knowledge, use, and conservation of ocean, coastal, and earth environments through a program of excellence in research, teaching, and service. From the 146-foot research vessel Hugh R. Sharp to one of the world's only tilting wind-wave tanks, and to state-of-the-art survey and GIS equipment, CMES maintains state-of-the-art research and teaching facilities on both the UD main campus in Newark and on the Hugh R. Sharp Campus in Lewes, at the mouth of the Delaware Bay.

Using these facilities, faculty and students are working to address complex earth and marine issues such as coastal pollution, fisheries decline, wetlands loss, global warming, and many others. Our faculty and students participate in research around the world as well as in our own Mid-Atlantic backyard.

For detailed information about the college's research and facilities, please visit the college Web site at:

<http://www.ocean.udel.edu>

For information specific to geology, please visit

<http://www.geology.udel.edu>

GEOLOGICAL SCIENCES

Telephone: (302) 831-2569

<http://www.geology.udel.edu>

The Department of Geological Sciences offers major programs leading to B.A. degrees in Geology and in Earth Science Education. The Department offers major programs leading to B.S. degrees in geology (including concentrations in Geophysics, Paleobiology, and Coastal and Marine Geoscience) and minors in geology and coastal and marine geoscience. Environmental Science majors can earn a minor in geology while earning a B.S. in Environmental Science.

- **Undergraduate Research Program**
- **Marine Policy Internship**
- **NSF Marine Sciences Summer Internship**

DEGREE: BACHELOR OF ARTS MAJOR: GEOLOGY

CURRICULUM CREDITS

See page 86 for University and other requirements.

MAJOR REQUIREMENTS

One of the following	4
GEOL 107 General Geology	4
GEOL 105/115 Geological Hazards and their Human Impact and Laboratory Note: GEOL 115 must be taken concurrently with GEOL 105.	
GEOL 113 Earth Science	4
GEOL 300 Earth's Materials I: Minerals	4
GEOL 302 Earth's Materials II: Rocks	4
GEOL 303 Earth's Surface I: Surficial Processes	4
GEOL 304 Earth's Surface II: Stratigraphy	4
GEOL 305 Earth Lithosphere I: Structural Geology and Plate Tectonics	4
GEOL 306 Earth's Lithosphere II: Field Geology	4
GEOL 307 Earth's History I: Paleobiology	4
GEOL 308 Earth's History II: Earth System Science	4
CHEM 103/104 General Chemistry	8
PHYS 201/202 Introductory Physics	8

Mathematics courses through college-level trigonometry 3-4

ELECTIVES

After required courses are completed, sufficient elective credits must be taken to meet the minimum credit requirement for the degree.

CREDITS TO TOTAL A MINIMUM OF 124

DEGREE: BACHELOR OF SCIENCE MAJOR: GEOLOGY

CURRICULUM CREDITS

UNIVERSITY REQUIREMENTS

ENGL 110 Critical Reading and Writing (minimum grade C-)	3
First Year Experience (see p. 64)	0-4
Discovery Learning Experience (see p. 64)	3
Three credits in an approved course or courses stressing multi-cultural, ethnic, and/or gender-related course content (see p. 64-66)	3

REQUIREMENTS ADOPTED FROM THE COLLEGE OF ARTS AND SCIENCES

Writing: (minimum grade C-)	3
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A second writing course involving significant writing experience including two papers with a combined minimum of 3,000 words to be submitted for extended faculty critique of both composition and content. This course must be taken after completion of 60 credit hours. Appropriate writing courses are normally designated in the semester's Registration Booklet. (See list of courses approved for second writing requirement, pages 89-91.)

Foreign Language: 0-12
 Completion of the intermediate-level course (107 or 112 or 214) in a given language. Number of credits needed and initial placement will depend on number of years of high school study of foreign language. Students with four or more years of high school work in a single foreign language may attempt to fulfill the requirement in that language by taking an exemption examination.

COLLEGE OF ARTS AND SCIENCES BREADTH REQUIREMENTS

(See pages 91-97)
 Group A 6
 Group B 6
 Group C 6

MAJOR REQUIREMENTS

One of the following 4
 GEOL 107 General Geology
 GEOL 105/115 Geologic Hazards and their Human Impact and Laboratory
 GEOL 113 Earth Science

GEOL 300 Earth's Materials I: Minerals 4
 GEOL 302 Earth's Materials II: Rocks 4
 GEOL 303 Earth's Surface I: Surficial Processes 4
 GEOL 304 Earth's Surface II: Stratigraphy 4
 GEOL 305 Earth Lithosphere I: Structural Geology and Plate Tectonics 4
 GEOL 306 Earth's Lithosphere II: Field Geology 4
 GEOL 307 Earth's History I: Paleobiology 4
 GEOL 308 Earth's History II: Earth System Science 4
 MATH 241/242 Analytic Geometry and Calculus A and B 8
 CHEM 103/104 General Chemistry 8
 PHYS 201/202 Introductory Physics I and II 8

Geology Electives 9-10
 (GEOL 385 or any 400-level or other GEOL courses approved in writing by department, including field courses taken as transfer work)
 A minimum grade of C- is required for any GEOL courses that count for the major.

Two of the following: 6-8
 GEOG 250 Computer Methods in Geography
 GEOG 372 Geographic Information Systems
 GEOG 471 Advanced Geographic Information Systems
 FREC 480 Geographic Information Systems in Natural Resource Management
 MATH 243 Analytic Geometry and Calculus C
 MATH 302 Ordinary Differential Equations

Other courses as approved in writing.

ELECTIVES

After required courses are completed, sufficient elective credits must be taken to meet the minimum credit requirement for the degree.

CREDITS TO TOTAL A MINIMUM OF 124

**DEGREE: BACHELOR OF SCIENCE
 MAJOR: GEOLOGY
 CONCENTRATION: GEOPHYSICS**

CURRICULUM CREDITS

UNIVERSITY REQUIREMENTS

ENGL 110 Critical Reading and Writing
 (minimum grade C-) 3

First Year Experience (see p. 64) 0-4

Discovery Learning Experience (see p. 64) 3

Three credits in an approved course or courses stressing multi-cultural, ethnic, and/or gender-related course content (see p. 64-66) 3

REQUIREMENTS ADOPTED FROM THE COLLEGE OF ARTS AND SCIENCES

Writing: (minimum grade C-) 3
 A second writing course involving significant writing experience including two papers with a combined minimum of 3,000 words to be submitted for extended

faculty critique of both composition and content. This course must be taken after completion of 60 credit hours. Appropriate writing courses are normally designated in the semester's Registration Booklet. (See list of courses approved for second writing requirement, pages 89-91.)

Foreign Language: 0-12
 Completion of the intermediate-level course (107 or 112 or 214) in a given language. Number of credits needed and initial placement will depend on number of years of high school study of foreign language. Students with four or more years of high school work in a single foreign language may attempt to fulfill the requirement in that language by taking an exemption examination.

COLLEGE OF ARTS AND SCIENCES BREADTH REQUIREMENTS

(See pages 91-97)
 Group A 6
 Group B 6
 Group C 6

MAJOR REQUIREMENTS

Within the Department
 One of the following 4
 GEOL 107 General Geology
 GEOL 105/115 Geologic Hazards and their Human Impact and Laboratory
 GEOL 113 Earth Science

GEOL 300 Earth's Materials I: Minerals 4
 GEOL 302 Earth's Materials II: Rocks 4
 GEOL 303 Earth's Surface I: Surficial Processes 4
 GEOL 304 Earth's Surface II: Stratigraphy 4
 GEOL 305 Earth Lithosphere I: Structural Geology and Plate Tectonics 4
 GEOL 306 Earth's Lithosphere II: Field Geology 4
 GEOL 307 Earth's History I: Paleobiology 4
 GEOL 308 Earth's History II: Earth System Science 4
 GEOL 453 Geophysics I 3
 GEOL 454 Geophysics II 3
 GEOL 405 Introduction to Research 3
 PHYS 207/208/209 Fundamentals of Physics I, II, and III 11
 PHYS 645 Electronics for Scientists 3
 MATH 241/242/243 Analytic Geometry and Calculus A, B and C 12
 MATH 302 Ordinary Differential Equations I 3

One of the following 3-4
 GEOG 250 Computer Methods in Geography
 CISC 106 General Computer Science for Engineers

CREDITS TO TOTAL A MINIMUM OF 125

**DEGREE: BACHELOR OF SCIENCE
 MAJOR: GEOLOGY
 CONCENTRATION: PALEOBIOLOGY**

CURRICULUM CREDITS

UNIVERSITY REQUIREMENTS

ENGL 110 Critical Reading and Writing
 (minimum grade C-) 3

First Year Experience (see p. 64) 0-4

Discovery Learning Experience (see p. 64) 3

Three credits in an approved course or courses stressing multi-cultural, ethnic, and/or gender-related course content (see p. 64-66) 3

REQUIREMENTS ADOPTED FROM THE COLLEGE OF ARTS AND SCIENCES

Writing: (minimum grade C-) 3
 A second writing course involving significant writing experience including two papers with a combined minimum of 3,000 words to be submitted for extended faculty critique of both composition and content. This course must be taken after completion of 60 credit hours. Appropriate writing courses are normally designated in the semester's Registration Booklet. (See list of courses approved for second writing requirement, pages 89-91.)

Foreign Language: 0-12
 Completion of the intermediate-level course (107 or 112 or 214) in a given language. Number of credits needed and initial placement will depend on number of years of high school study of foreign language. Students with four or more years of high school work in a single foreign language may attempt to fulfill the requirement in that language by taking an exemption examination.

COLLEGE OF ARTS AND SCIENCES BREADTH REQUIREMENTS

(See pages 91-97)

Group A	6
Group B	6
Group C	6

MAJOR REQUIREMENTS

One of the following	4
GEOL 107 General Geology	
GEOL 105/115 Geologic Hazards and their Human Impact and Laboratory	
GEOL 113 Earth Science	
GEOL 300 Earth's Materials I: Minerals	4
GEOL 302 Earth's Materials II: Rocks	4
GEOL 303 Earth's Surface I: Surficial Processes	4
GEOL 304 Earth's Surface II: Stratigraphy	4
GEOL 305 Earth Lithosphere I: Structural Geology and Plate Tectonics	4
GEOL 306 Earth's Lithosphere II: Field Geology	4
GEOL 307 Earth's History I: Paleobiology	4
GEOL 308 Earth's History II: Earth System Science	4
GEOL 405 Introduction to Research	3
Geology Electives	6
(GEOL 385 or any 400-level GEOL or other GEOL courses approved in writing by the department, including field courses taken as transfer work.)	
BISC 207/208 Introductory Biology I and II	8
BISC 495 Evolution	3
CHEM 103/104 General Chemistry	8
One of the following	3
BISC 302 General Ecology	
BISC 321 Environmental Biology	
Two of the following	8
BISC 303 Genetic and Evolutionary Biology	
BISC 371 Introduction to Microbiology	
BISC 480 Vertebrate Natural History	
One of the following	3
MATH 210 Discrete Mathematics I	
MATH 230 Finite Mathematics with Applications	
MATH 241 Analytic Geometry and Calculus A	4
MATH 205 Statistical Methods	4

ELECTIVES

After required courses are completed, sufficient elective credits must be taken to meet the minimum credit requirements for the degree.

CREDITS TO TOTAL A MINIMUM OF 124

DEGREE: BACHELOR OF SCIENCE
MAJOR: GEOLOGY
CONCENTRATION: COASTAL AND MARINE GEOSCIENCE

CURRICULUM CREDITS

UNIVERSITY REQUIREMENTS

ENGL 110 Critical Reading and Writing (minimum grade C-)	3
First Year Experience (see p. 64)	0-4
Discovery Learning Experience (see p. 64)	3
Three credits in an approved course or courses stressing multi-cultural, ethnic, and/or gender-related course content (see p. 64-66)	3

REQUIREMENTS ADOPTED FROM THE COLLEGE OF ARTS AND SCIENCES

Writing: (minimum grade C-)	3
A second writing course involving significant writing experience including two papers with a combined minimum of 3,000 words to be submitted for extended faculty critique of both composition and content. This course must be taken after completion of 60 credit hours. Appropriate writing courses are normally designated in the semester's Registration Booklet. (See list of courses approved for second writing requirement, pages 89-91.)	
Foreign Language:	0-12
Completion of the intermediate-level course (107 or 112 or 214) in a given language. Number of credits needed and initial placement will depend on number of years of high school study of foreign language. Students with four or more years of high school work in a single foreign language may attempt to fulfill the requirement in that language by taking an exemption examination.	

COLLEGE OF ARTS AND SCIENCES BREADTH REQUIREMENTS

(See pages 91-97)

Group A	6
Group B	6
Group C	6

MAJOR REQUIREMENTS

One of the following	4
GEOL 107 General Geology	
GEOL 105/115 Geologic Hazards and their Human Impact and Laboratory	
GEOL 113 Earth Science	
GEOL 300 Earth's Materials I: Minerals	4
GEOL 302 Earth's Materials II: Rocks	4
GEOL 303 Earth's Surface I: Surficial Processes	4
GEOL 304 Earth's Surface II: Stratigraphy	4
GEOL 305 Earth Lithosphere I: Structural Geology and Plate Tectonics	4
GEOL 306 Earth's Lithosphere II: Field Geology	4
GEOL 307 Earth's History I: Paleobiology	4
GEOL 308 Earth's History II: Earth System Science	4
GEOL 431 Marine Geology	3
GEOL 434 Geology of Coasts	3

BISC 207/208 Introductory Biology I and II	8
CHEM 103/104 General Chemistry	8
ENWC/MAST 314 Comparative Terrestrial and Marine Ecology	3
MATH 241/242 Analytic Geometry and Calculus I and II	8
MAST 482 Introduction to Ocean Sciences	3
PHYS 201/202 Introductory Physics I and II	8

Six credits from the following list of courses or any other courses approved in writing by the Department

MAST 366 or 466 Independent Study	6 (maximum)
(only by prior instructor approval)	
MAST 464 Marine Science Summer Internship	3
or	
MAST 468 Undergraduate Research	3 (at least)
MAST 602 Physical Oceanography	3
MAST 606 Ocean and Atmosphere Remote Sensing	3
MAST 627 Marine Biology	3
MAST 637 Geological Oceanography	3
MAST 646 Chemical Oceanography	3
GEOG/MAST 681 Remote Sensing of Environment	3

CREDITS TO TOTAL A MINIMUM OF 125

MINOR IN GEOLOGY

The minor consists of at least 18 credit hours in geology. The requirements are: GEOL 107 or GEOL 105 and 115, or GEOL 113; plus additional courses at the 300- 400-level to obtain the remaining credits to reach a total of 18.

For Environmental Science majors, the requirements for the minor in Geology are GEOL 107, or GEOL 105 and 115, or GEOL 113; GEOL 303; at least one other GEOL course at the 300-level; plus additional courses at the 300- and 400-level to obtain the remaining credits to reach a total of 18.

MINOR IN COASTAL AND MARINE GEOSCIENCE

A minimum of 18 credits of course work in Coastal and Marine Geoscience must be completed for a minor. The following courses are required (within the stated options); others can be added (as listed below) to obtain additional credits in related disciplines.

CURRICULUM CREDITS

GEOL 107 General Geology	
or	
GEOL 105/115 Geological Hazards	
or	
GEOL 113 Earth Science	4
At least one full-year sequence of 300-level courses (e.g. 300-302, 303-304, 305-306, or 307-308)	8
MAST 482 Introduction to Ocean Sciences	3
GEOL 431 Marine Geology	3

TOTAL CREDITS 18

DEGREE: BACHELOR OF ARTS
MAJOR: EARTH SCIENCE EDUCATION

CURRICULUM CREDITS

See page 86 for University and other requirements.

MAJOR REQUIREMENTS

GEOL 105/115	Geologic Hazards and their Human Impact and Laboratory	4
GEOL 107	General Geology	4
GEOL 300	Earth's Materials I: Minerals	4
GEOL 303	Earth's Surface I: Surficial Processes	4
GEOL 306	Earth's Lithosphere II: Field Geology	4
GEOG 101	Physical Geography	3
GEOG 220	Meteorology	3
GEOG 235	Conservation of Natural Resources	3
One of the following		3
GEOG 343	Climatic Geomorphology	
GEOG 255	Applied Climatology	
PHYS 133	Introduction to Astronomy	4
PHYS 201/202	Introductory Physics I and II	8
CHEM 103	General Chemistry	4
BISC 195	Biological Evolution	3
MATH 221	Calculus I	3
MAST 200	The Oceans	3
A grade of C- or better is required in BISC 195, MAST 200, PHYS 133, and SCEN 491 and all of the required EDUC, GEOG, and GEOL courses.		
EDUC 413	Adolescent Development and Educational Psychology	4
EDUC 414	Teaching Exceptional Adolescents	3
EDUC 419	Diversity in Secondary Education	3
EDUC 420	Reading in the Content Area	1
EDUC 430	Classroom Management in Schools	1
EDUC 400	Student Teaching	9
SCEN 491	Teaching Science in Secondary Schools	4

To be eligible to student teach, Earth Science Education students must have an overall GPA of 2.50 with a GPA of 2.75 in BISC 195, MAST 200, PHYS 133 and their geology and geography courses. They must also pass a teacher competency test as established by the University Council on Teacher Education. Students must consult with the teacher education program coordinator (see list on p. 205) to obtain the student teaching application and other information concerning student teaching policies.

CREDITS TO TOTAL A MINIMUM OF 124

DEGREE: BACHELOR OF SCIENCE
MAJOR: ENVIRONMENTAL SCIENCE

A B.S. degree in Environmental Science is offered through the Department of Geography, in cooperation with the College of Marine and Earth Studies and the Department of Biological Sciences. Coursework includes geography, biology, geology, and other marine studies classes.

The program emphasizes a broad scientific understanding of the character, function, and analysis of environmental systems. For more information, please visit <http://www.udel.edu/Environmentsci>. For degree requirements, please see page 128 of this catalog.

UNDERGRADUATE COURSES IN MARINE STUDIES

“The Ocean” (MAST 200) is designed primarily for non-science majors and provides an overview of how the ocean works. This course integrates basic physical, chemical, geological, and biological principles while exploring topics ranging from why the ocean is salty to the status of the world’s fisheries.

A more advanced course, “Introduction to Ocean Science” (MAST 482), is geared to junior and senior students pursuing majors and careers in environmental studies, physical and life sciences, or engineering. It is designed both as a stand-alone course and to prepare students for graduate-level oceanography courses. It provides

a more detailed introduction to the ocean including seafloor geography, the chemistry of water and sediments, the physics of ocean circulation, and the biology of the seas. The course takes a problem-solving approach requiring introductory calculus, chemistry, and physics. Subjects covered include global climate change, marine biodiversity, hydrothermal vent communities, coastal pollution, waning fish stocks, and the ozone hole.

Advanced undergraduate students may enroll in entry-level graduate courses in marine studies with the instructor’s permission. While some classes are taught at the CMES research complex in Lewes, 90 miles south of the main campus, interactive television linking the two sites allows Newark-based students to attend without commuting to Lewes.

CMES also sponsors the following programs for upper-division students that immerse them in a graduate-student atmosphere and introduce them to the work of marine scientists.

SEMESTER-IN-RESIDENCE

This program is developed especially for juniors and seniors at the University of Delaware. Each year, up to 12 students with a minimum 3.0 grade-point average are selected to spend a semester at the Lewes campus in an intensive exploration of marine science. Inexpensive housing is available at the student housing complex in Lewes. The experience includes graduate-level course work and seminars as well as an individual research project guided by a faculty advisor. The nature of this program necessitates that interested students begin planning fairly early in their college career to incorporate this special semester into their curriculum. The program can provide a valuable, advance look at the graduate school experience.

For more information, contact:
 Dr. Charles Epifanio
 University of Delaware
 College of Marine and Earth Studies
 700 Pilottown Road
 Lewes, DE 19958-1298
 E-mail: epi@udel.edu
www.ocean.udel.edu/graduate/sem-in-res.html

UNDERGRADUATE RESEARCH PROGRAM

The Undergraduate Research Program is open to all interested undergraduates. Undergraduate research can begin as early as the freshman year. Advisors in the program office can help you clarify your research interests and identify and approach appropriate faculty members. A directory listing nearly 600 participating faculty members and their research interests -- including many College of Marine and Earth Studies faculty -- is available to assist you in locating the best position for you. Most students earn academic credit for their research assistance, but in some cases, usually during the summer, a stipend is available.

Special research opportunities are open to undergraduates participating in the University Honors Program or the Science and Engineering Scholars Program. The top 20% of sophomore science and engineering majors are invited to join the latter. Science Scholars may spend 10 weeks during the summer following their sophomore year conducting research under the guidance of a faculty member and receive a stipend for their work. For honors students, undergraduate research may culminate in the senior thesis required for an Honors Degree or Degree with Distinction. Faculty from the College of Marine and Earth Studies frequently have served as thesis advisors.

For more information, contact:
 University of Delaware
 Undergraduate Research Program
 12 W. Delaware Ave.
 Newark, DE 19716
 Phone: (302) 831-8995
 E-mail: undergradresearch@udel.edu
www.urp.udel.edu

MARINE POLICY INTERNSHIP

Qualified undergraduates may serve as interns in the Gerard J. Mangone Center for Marine Policy at CMES and work on a range of research and policy analysis activities with graduate students, faculty, and national and international agencies. The center conducts an active research program at international, national, and regional scales; provides policy advice to governmental and nongovernmental entities; and organizes conferences, publications, international exchanges, and a visitors program. Major emphases include implementation of the Earth Summit agreements related to the oceans and coasts, the theory and practice of integrated coastal management, the management of coastal ecosystem health, and marine biotechnology. Center activities are carried out by the director, Biliana Cicin-Sain, in association with other UD faculty, scholars at other universities, international associates, practitioners in the field, postdoctoral fellows, and research assistants.

For more information, contact:
 Dr. Biliana Cicin-Sain, Director
 University of Delaware
 Gerard J. Mangone Center for Marine Policy
 College of Marine and Earth Studies
 301 Robinson Hall
 Newark, DE 19716
 E-mail: bcs@udel.edu

NSF MARINE SCIENCES SUMMER INTERNSHIP

NSF MARINE SCIENCES SUMMER INTERNSHIP

Each summer, with support from the National Science Foundation (NSF), CMES awards internships to approximately 10 science, engineering, and mathematics undergraduates from around the country, giving them the opportunity to conduct 10 weeks of guided research at the College of Marine and Earth Studies' Hugh R. Sharp Campus in Lewes. Interns work on a research project in chemical, physical, or biological oceanography, marine biology, marine geology, or marine biochemistry; participate in a research cruise aboard the 146-foot research vessel Hugh R. Sharp; and present their results in oral and written reports at the end of the summer. They also attend weekly seminars for which they receive one credit. Student support, provided by grants from the NSF Research Experiences for Undergraduates Office, includes a \$3,300 stipend, dormitory fee, tuition for the one-credit course, and travel assistance. Applicants must be citizens or permanent residents of the United States and its possessions and must be enrolled in a degree program leading to a bachelor's degree. Students between their junior and senior years receive preference. The deadline for applications is usually in late February, with student selection and notification made by April of each year.

For more information, contact:
 Dr. Ana I. Dittel
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 College of Marine and Earth Studies
 700 Pilottown Road
 Lewes, DE 19958-1298
 E-mail: adittel@udel.edu
www.ocean.udel.edu/graduate/reu.html

