

MARINE SCIENCE (MSCI)

MSCI 201 Marine Science Mash-Up (1 Credit)

Marine scientists conduct research in areas such as biological oceanography, earth science, fisheries science, physical sciences (e.g., physical and chemical oceanography), and human-natural couplings in marine and coastal ecosystems. Scientists in this discipline are also engaged in collaborative research that crosses over these fields of study and connects to fields outside the natural sciences such as the social sciences, government and law, economics, and communication. This 1-credit course introduces students to the interdisciplinary field of marine science through presentations by faculty, staff, and students conducting marine science research, education, advisory service, and outreach at William & Mary's Virginia Institute of Marine Science. By meeting these people and completing course assignments students will learn about how marine scientists study these topics, the availability of opportunities for student research, and the potential benefits of pursuing Marine Sciences as a course of study and/or career.

MSCI 230 Introduction to Marine Science (3 Credits)

This course provides a comprehensive, introductory overview of marine science, exploring oceanic systems, coastal environments, and the organisms that live there. The course emphasizes the key geological, physical, chemical, and biological processes that characterize the ocean system, highlights the interdisciplinary linkages among them, examines the fundamental role of the oceans in controlling the larger Earth system, and explores the myriad ways the oceans impact – and are impacted by – humans. As a COLL 200 course, concepts are linked to related fields of study in the social sciences and humanities. The course is designed to be accessible to students with both scientific and non-scientific backgrounds, and is the entry point for W&M's Major and Minor in Coastal & Marine Sciences.

College Curriculum: C200

Domain: NQR

MSCI 250 People, Society, and the Coast (3 Credits)

This course is designed to provide students with an introduction and overview of the human dimensions of marine science, with the additional intent to inspire students to consider the human dimensions of their own research and areas of interest. Students will examine the intricate relationship between coastal communities and their environments. Students will explore social, economic, and cultural dimensions of coastal living, including resource management, tourism, and environmental justice. Through case studies and discussions, participants will analyze how human activities influence coastal ecosystems and vice versa. The course also addresses policy implications and conservation strategies aimed at promoting sustainable coastal development. By integrating perspectives from sociology, economics, and environmental science, students will gain a holistic understanding of the challenges and opportunities facing coastal societies today.

MSCI 305 Coastal and Marine Geology (3 Credits)

Focusing on the geological aspects of shallow coastal to deep-water marine environments, students in this course will delve into topics including the age and internal structure of the earth, the processes of plate tectonics including the formation of oceanic crust, seamounts, hydrothermal vents, the characteristics and classification of sediments and the distribution of sediments in the deep sea. Also addressed are the key processes acting within coastal, estuarine, and marine environments, as well as the records of past changes in sea level, climate, and physical oceanography contained within their sedimentary deposits. This course also includes discussion of various types of field equipment and geological data types, as well as some economic and societal implications of marine geological deposits and processes.

Prerequisite(s): (MSCI 230 or MSCI 330 or BIOL 330 or ENSP 230 or GEOL 330) or (GEOL 160 or GEOL 250)

MSCI 310 Motion of the Ocean (3 Credits)

To introduce students to the theoretical, observational, and numerical study of physical oceanography. The course will develop concepts and quantitative frameworks that are fundamental to understanding ocean circulation and dynamics. The theory part of the course will cover topics including the distribution of fundamental ocean physical properties, ocean-atmosphere radiative balance, the seawater equation of state, the continuity equation, and the momentum equation. The observational component of the course will cover ocean observing technologies, methods, and have students apply their theoretical knowledge to explain observed phenomena. Finally, for the numerical portion of the course, the students will learn to conduct basic data analysis and explore numerical modeling tools.

Prerequisite(s): MSCI 230 or MSCI 330 or BIOL 330 or ENSP 330 and (PHYS 101 or PHYS 107)

MSCI 315 Biological Oceanography (3 Credits)

This course examines the biology and ecology of marine organisms and how they interact with their environment. Topics include the organisms and their behavior, distribution, and underlying physiology; effects of biology on elemental and nutrient cycles and vice versa; and ecosystem structure and ecological interactions. An interdisciplinary approach will be taken, as biology both depends on and influences ocean chemistry, physics, geology, and climate. The course will emphasize open ocean, pelagic systems, but will include many examples from coastal and estuarine systems, as well as shallow and deep-sea benthic systems.

Prerequisite(s): (MSCI 230 or MSCI 330 or BIOL 330 or ENSP 230 or GEOL 330) and BIOL 204 and BIOL 204L

MSCI 320 Coastal and Marine Chemistry (3 Credits)

This course provides a comprehensive introduction to key coastal and marine chemistry concepts and an integrated perspective into the biogeochemical processes governing the distribution major and trace elements, gases and organic matter in the coastal realm and ocean interior. Discussion topics will include the chemical properties of seawater, chemical equilibrium and kinetics, the seawater carbonate system and ocean acidification, the global and oceanic carbon and nitrogen cycles, ion speciation, trace metals, and nutrients, sediment diagenesis, and fundamentals of radioisotope and stable isotope biogeochemistry. Besides lectures, which will cover the major aspects, tools, and new developments in the field, this course will review numerous papers through group discussion to delve further into topics using relevant scientific literature.

Prerequisite(s): MSCI 230 and (CHEM 103 or CHEM 205)

MSCI 331 Field Studies in Coastal Marine Environments (3 Credits)

This course focuses on fundamental processes in marine science through the examination of the near shore, barrier island, coastal lagoon, and salt marsh environments along Virginia's outer coast. Through a series of field trips, lectures, laboratory exercises and independent projects, students will examine the fauna and flora of the region and learn how natural and anthropogenic factors shape these coastal ecosystems. Housing is provided in dormitories at the Batten School & VIMS Eastern Shore Laboratory, and meals are also included. An additional course fee is required to cover the cost of meals.

Prerequisite(s): MSCI 330 or GEOL 330 or ENSP 230 or BIOL 330 or BIOL 230 or MSCI 230

MSCI 332 Coastal Environments in North Wales: Geology, Ecology, and Human Dimensions (3 Credits)

This is an intensive, 16-day, field-based course conducted in north Wales, U.K. in association with the School of Ocean Sciences, Bangor University. The course emphasizes field-based instruction and student-led data collection in coastal marine environments in northern Wales and the Isle of Anglesey. Topics include the geological history and paleoecology of the region, the ecology of rocky shores, and the biological and physical processes affecting species distribution and ecology in high energy macrotidal coastal environments. The course will also explore the interplay between regional geology and geography and the area's social and economic development, particularly around the mining of extensive copper and slate deposits starting in the late Paleolithic through the Roman Period, English conquest, and into modern times.

Prerequisite(s): MSCI 330 or BIOL 330 or GEOL 330 or ENSP 230 or MSCI 230 or BIOL 230

Additional fees apply

College Curriculum: C30G

MSCI 333 Coastal Environments – Topics (3 Credits)

This course focuses on fundamental processes in coastal and marine science through field-based examination of coastal and shallow marine environments, processes, and records. Course addresses field techniques and their application in the study of coastal and marine science of selected regions, which vary with course offering. This course may be repeated for credit. Two to four-week field trip is the central component of the course. Fee Required.

Additional fees apply

MSCI 340 Marine Biology (3 Credits)

This course is an introduction into marine biology. Although I will cover some basic aspects of the ocean, its physical structure and seawater as a medium, so as to understand the environments faced by marine organisms, it is not meant as an oceanography course. I will focus on the organisms, their adaptations to the marine environment, and the ecological processes regulating life in the oceans. The course will cover aspects of marine biology from the shore to the deep sea. The course will then survey the structure, adaptations, and life styles of marine organisms, and examine how organisms have adapted to live in the disparate habitats in our oceans. Finally, the course will integrate the organismal information to examine ecological concepts and ecosystem processes in the major marine systems. Current issues in marine environmental management and conservation will also be discussed, including oil spills and their effects on marine life, the ramifications of the Exclusive Economic Zone, plastics waste, overfishing, and the development of marine protected areas.

Prerequisite(s): BIOL 204

MSCI 360 Field and Research Methods in Marine Science (4 Credits)

In this intensive field course, students will be introduced to several practical skills and methodologies used in coastal and marine science research. Students will gain "hands-on" experience with data collection, different sampling techniques, and analyses used in various settings. The techniques will be applied to practical problems in coastal settings. Emphasizing fieldwork during the immersion semester, the course includes excursions to coastal and marine sites, where participants will apply scientific methods to gather data for later analyses. By the end of the course, students will be able to demonstrate basic techniques that will allow them to undertake more advanced courses and participate in real-world coastal and marine sciences research.

Corequisite(s): MSCI 320, MSCI 365

MSCI 365 Quantitative Methods in Marine Science (3 Credits)

This course illustrates quantitative methods essential for analyzing estuarine, coastal, and marine science data through examples and case studies. Students will learn different statistical and computational tools routinely used to analyze, interpret, and visualize data, develop models, and solve problems relevant to coastal and marine ecosystems and processes. Emphasis will be placed on hands-on learning through case studies, datasets, and projects drawn from real-world examples of research in marine science. Topics may include reading and interpretation of scientific figures and tables, introductory-level statistical methods, spatial analysis tools (e.g., GIS), and basic programming. By the end of the course, students will have improved their quantitative literacy in a manner that enhances their readiness to critically evaluate scientific data and develop research capabilities in interdisciplinary marine science.

Prerequisite(s): MSCI 230 or MSCI 330 or BIOL 330 or ENSP 230

Corequisite(s): MSCI 360

MSCI 390 Research in Marine Science (1-3 Credits)

This course is designed to permit students (particularly marine science minors) to engage in independent research. Students will work closely with a faculty member as an advisor. Each student will be expected to conduct research and prepare research paper appropriate for the number of credits. This course may be repeated for credit.

MSCI 398 Marine Science Seminar (1-3 Credits)

Seminar in interdisciplinary topics in coastal and marine sciences. The course topic, prerequisites, and instructors will vary from year to year.

Commonly, the prerequisite for this course is MSCI 230.

MSCI 404 Microbial Processes in a Changing Coastal Environment (2 Credits)

Microbial Processes in a Changing Coastal Environment: The course will address current topics and societal concerns in coastal and estuarine systems including microbial responses to eutrophication, harmful algal blooms, nutrient enrichment, and roles of bivalve-dominated systems, marshes, seagrasses, groundwater, and photic sediments on microbial nutrient cycling.

MSCI 411 Coastal and Marine Pollution (2 Credits)

Welcome to CAMP, where you'll dive into the ever-changing and complex world of Coastal And Marine Pollution! This course provides a foundation on the scientific concepts underpinning pollutant research, including environmental chemistry and toxicology. From plastics to PFAS, and everything in between, students will develop and understanding of the sources, fates, and effects of synthetic contaminants in aquatic systems. Prerequisite(s): (MSCI 230 or MSCI 330 or BIOL 330 or ENSP 230 or GEOL 330 and CHEM 103)

MSCI 422 Coastal Evolution (3 Credits)

This course will review the drivers of, and geomorphic responses to, change along open-ocean coastal sedimentary environments across a range of climatic zones and from the event scale to thousands of years.

MSCI 425 Ethics in Marine Science (3 Credits)

This seminar-style course explores ethical issues in marine science from diverse perspectives and interprets them through the framework of major ethical theories. Topics include marine resource and land management, research methods, and the societal impacts of climate change. Students will examine how knowledge is produced, who bears responsibility for conducting marine science, and how societal factors shape both. Active participation in discussions is expected, as students learn to critically evaluate, construct, and defend arguments on key ethical topics.

Prerequisite(s): MSCI 230 or MSCI 330 or BIOL 330 or ENSP 230 or GEOL 330 or PHIL 215 or PHIL 303 or PHIL 308

College Curriculum: C350

MSCI 456 Coastal GIS (3 Credits)

Coastal GIS introduces geographic information systems through applications in coastal environments. Using open-source tools such as QGIS, Whitebox Tools, and selected R/Python workflows, students learn to organize, map, and analyze spatial data relevant to shorelines, marshes, estuaries, and coastal communities. Topics include vector and raster data, cartography, geoprocessing, reclassification, neighborhood statistics, cost-distance, kernel density, spatial interpolation, and habitat suitability modeling. The course emphasizes the strengths and limitations of common GIS methods in coastal systems, especially where straight-line distance assumptions do not reflect ecological or hydrologic reality. This course is taught on the VIMS campus in Gloucester Point.

Prerequisite(s): MSCI 230

MSCI 457 Economies of the Coast (3 Credits)

This course explores key economic sectors of coastal communities around the world—seafood production, tourism and recreation, real estate, and energy—illustrating economic concepts, ideas, and tools through a variety of case studies and real-world applications. Topics covered are expected to include rational choice theory, trade and market formation, externalities, ecosystem goods and services, and tools of policy evaluation.

MSCI 460 Senior Seminar (3 Credits)

This course will examine how physical, geological, chemical and biological processes in the oceans together affect the planet's climate in different time and spatial scales. Abrupt climate change caused by recent human activities will also be discussed.

Prerequisite(s): (MSCI 230 or MSCI 330 or ENSP 230 or BIOL 330 or GEOL 330) and MSCI 250

MSCI 490 Introduction to Advanced Research in Coastal & Marine Sciences (1 Credit)

This course is intended to introduce students to the principles and practices of research in Coastal & Marine Sciences, with an emphasis on developing independent, proposal-driven projects. Topics include formulating research questions, conducting literature reviews, designing feasible and ethical studies, research budgeting, and responsible conduct of research. Students develop skills in scientific writing and oral communication while learning to align research methods with project objectives and logistical constraints. The course culminates in a written research prospectus and an oral presentation, providing preparation for Senior Research, Honors Research, and other independent research experiences.

Prerequisite(s): MSCI 230 or (MSCI 330 or BIOL 230 or BIOL 330 or GEOL 330)

MSCI 491 Senior Research in Coastal & Marine Sciences (3 Credits)

Senior Research provides students with the opportunity to conduct mentored, independent research in Coastal & Marine Sciences under the supervision of a faculty advisor. Students develop and carry out an original research project, gaining experience in formulating research questions, synthesizing scientific literature, collecting and analyzing data, and communicating results. Emphasis is placed on critical thinking, scientific inquiry, and professional research skills. The course culminates in a written Senior Research Thesis and an oral presentation of findings. Research activities are conducted independently in consultation with the faculty mentor; no regular class meetings are held.

Prerequisite(s): MSCI 230 and MSCI 490 (may be taken concurrently)

College Curriculum: C400

MSCI 495 Honors Research in Coastal & Marine Sciences (3 Credits)

Honors Research provides academically qualified students with the opportunity to conduct sustained, semi-independent research in Coastal & Marine Sciences under the supervision of a faculty advisor. Over two semesters, students develop and carry out an original research project, engaging in advanced literature review, experimental or analytical design, data interpretation, and scientific communication. Emphasis is placed on intellectual independence, critical inquiry, and professional research skills. The course culminates in a written Honors Thesis and an oral presentation and defense before an examining committee. Research activities are conducted independently in consultation with the faculty mentor; no regular class meetings are held.

Prerequisite(s): MSCI 230 and MSCI 490 (may be taken concurrently)

College Curriculum: C400

MSCI 496 Honors (3 Credits)

This two-semester course sequence is intended to support students through the completion of independent honors theses in coastal and marine sciences. Students will develop study proposals, conduct mentored data collection, and present results. During the first semester students will develop skills required for completion, including generating hypotheses, compiling and synthesizing primary literature, designing figures, and communicating science. In the second semester students will complete the independent honors research study and a comprehensive exam in marine science, culminating in a written paper and a formal presentation and committee-led defense. It is expected that students choosing the honors research route will have completed at least one full semester and/or summer of research for pay or credit (e.g., MSCI 390) and therefore be at an advanced stage of data collection and analysis prior to their senior year. Enrollment is restricted to coastal and marine science majors, normally in their senior year, and is by instructor (primary research advisor) permission only. Note: For College provisions governing the Admission to Honors, see the Department Honors section of the catalog under Requirements for the Baccalaureate Degree.

Prerequisite(s): MSCI 230 and MSCI 490 (may be taken concurrently)

MSCI 497 Prob: Marine Science (1-4 Credits)

This is the avenue through which supervised projects are selected to suit the need of the upper level undergraduate student. Projects are chosen in consultation with the student's supervising professor and the instructor. Credit hours depend upon the difficulty of the project and must be arranged with the instructor in advance of registration.

MSCI 498 Special Topics in Marine Science (1-3 Credits)

This is the avenue through which subjects not covered in other formal courses are offered. These courses are offered on an occasional basis as demand warrants.