

MARINE SCIENCE (MSCI)

MSCI 501 - Principles of Geomorphology (3 Credits)

The process of earth denudation with emphasis on chemistry of weathering, stream and erosion hydraulics, quantitative analysis of land form evolution.

Prerequisites: C or better in GEOL 101.

Cross-listed course: GEOL 501

MSCI 502 - Principles of Coastal Geomorphology (4 Credits)

Geological and physical controls on the morphology, development, and stability of coastlines. Analysis of waves and erosional processes, and coastal zone morphodynamics. Several required field trips.

Prerequisite or Corequisite: MATH 122 or MATH 141.

Cross-listed course: GEOL 502

MSCI 503 - Environmental Microbiology (3 Credits)

An overview of the microbial world including a survey of the distribution, functioning, and diversity of microorganisms in natural systems. Discusses the crucial roles that microorganisms play in ecosystem function, biogeochemical cycles, and environmental quality.

Prerequisites: MSCI 102 or BIOL 102, CHEM 112.

Cross-listed course: BIOL 502

MSCI 504 - Climate Geoengineering (3 Credits)

This course will discuss the urgent need for deploying solar radiation and carbon dioxide removal approaches at scale, including potential benefits and risks of these options. It will also discuss regulatory and governance considerations at both the national and international level and strategizes to incentivize large-scale adoption of these approaches.

Cross-listed course: ENVR 504, GEOL 504

MSCI 505 - Senior Seminar (1 Credit)

CL: 2020.

MSCI 509 - MATLAB-Based Data Analysis in Ocean Sciences (3 Credits)

MATLAB-based course in processing, analysis, and visualization of large oceanographic data sets. Includes scalar and vector time series measured at fixed locations as well as shipboard surveys of oceanographic characteristics varying both in 3-D and in time. Methods and techniques are relevant to other geoscience disciplines.

Prerequisites: MATH 141.

MSCI 510 - Invertebrate Zoology (4 Credits)

Phylogenetic and comparative aspects of anatomy, physiology, reproduction, and embryology of the invertebrates. Three lecture and one three-hour laboratory period per week.

Prerequisites: BIOL 301 or MSCI 311.

Cross-listed course: BIOL 510

Graduation with Leadership Distinction: GLD: Research

MSCI 511 - Advanced Paleontology (3 Credits)

Systematic, ecologic, biogeographic, and evolutionary aspects of paleontology; lectures, practical exercises, field trips.

Prerequisites: C or better in GEOL 305.

Cross-listed course: GEOL 511

MSCI 515 - Marine Micropaleontology (4 Credits)

Marine microfossils; distribution, ecology, paleoecology, and biostratigraphy; use of microfossils in marine sediments to study oceanographic history. Three lectures and two laboratory hours per week.

Cross-listed course: GEOL 515

MSCI 521 - Introduction to Geochemistry (3 Credits)

Investigation of low temperature chemical reactions controlling the geochemistry of the earth's surface. Emphasis on CO₂, carbonates, oxidation reduction, thermodynamics, isotopes, biogeochemistry.

Cross-listed course: GEOL 521

MSCI 524 - Environmental Radioisotope Geochemistry (3 Credits)

Introduction to radioactivity and the use of radionuclides to study environmental processes, including age-dating and biogeochemical cycling in aquatic systems.

Prerequisites: C or better in CHEM 111, CHEM 112, and MATH 141.

Cross-listed course: GEOL 524

MSCI 525 - Marine Plants (4 Credits)

Diversity, distribution, physiology, ecology, evolution, and economic importance of marine algal, seagrass, and mangrove communities. Three lecture and three laboratory hours per week. Scheduled field trips are required.

Prerequisites: BIOL 301 or MSCI 311.

Cross-listed course: BIOL 525

MSCI 535 - Fishery Management (3 Credits)

Management and conservation of aquatic and marine resources, with emphasis on fisheries. Data procurement and analysis; commercial and recreational fisheries; sociological, political, legal, and environmental factors that affect fishery management; and fish biodiversity.

Prerequisites: BIOL 301.

Cross-listed course: BIOL 535

MSCI 536 - Ichthyology (4 Credits)

Phylogeny, morphology, behavior, and ecology of fishes. Three lecture and 3 laboratory hours plus three field trips to be arranged.

Prerequisites: BIOL 301 or MSCI 311.

Cross-listed course: BIOL 536

Graduation with Leadership Distinction: GLD: Research

MSCI 537 - Aquaculture (3 Credits)

Introduction to the practical and scientific aspects of the commercial culture of freshwater and marine organisms. Three lecture hours per week. One all-day field trip required.

Prerequisites: BIOL 301 or MSCI 311.

Cross-listed course: BIOL 537

MSCI 538 - Behavior of Marine Organisms (4 Credits)

The identification of behavioral adaptations of estuarine and marine organisms: their ecology, physiology, development, and evolutionary history; field observations.

Prerequisites: BIOL 101 and BIOL 102 or MSCI 311.

Cross-listed course: BIOL 538

Graduation with Leadership Distinction: GLD: Research

MSCI 545 - Geological Oceanography (3 Credits)

A comprehensive study of the origin and development of the major structural features of the ocean basins and the continental margins. Discussion of the techniques used in obtaining geologic data and the interpretation of sedimentary processes, vulcanism, and the stratigraphy of the ocean basins.

Cross-listed course: GEOL 545

MSCI 550 - Sedimentary Simulations and Sequence Stratigraphy (4 Credits)

Problems of sequence stratigraphy resolved with graphic computer simulations. Sedimentary fill of basins by carbonates and/or clastics tracked as a function of rate of sediment accumulation, tectonic behavior, and sea level. Includes laboratory.

Prerequisites: GEOL 325.

Cross-listed course: GEOL 550

MSCI 552 - Population Genetics (3 Credits)

An introduction to the principles of population genetics, with emphasis on the origin, maintenance, and significance of genetic variation in natural populations.

Prerequisites: C or better in BIOL 301 or MSCI 311.

Cross-listed course: BIOL 552

Graduation with Leadership Distinction: GLD: Research

MSCI 553 - Marine Sediments (3 Credits)

Marine sedimentary environments; physical/biological factors which control the formation and distribution of modern marine sediments.

Prerequisites: GEOL 516.

Cross-listed course: GEOL 553

MSCI 555 - Conservation and Health in Marine Systems (3 Credits)

Introduces the field of conservation and explores the intersection between conservation and environmental health with a particular focus on coastal and marine case studies.

MSCI 557 - Coastal Processes (3 Credits)

Physical and geological processes controlling the formation and evolution of beach, barrier, and nearshore environments, including discussion of coastal management issues.

Cross-listed course: GEOL 557

MSCI 566 - Ecosystem Analysis (3 Credits)

The formulation and simulation of compartment models of marine and terrestrial ecosystems with complex nutrient cycling, food chains, and energy flow. Analog and digital simulation techniques. Ecosystem stability and sensitivity. Organization, structure, and diversity of an ecosystem.

MSCI 568 - Introduction to Micrometeorology (3 Credits)

Small-scale processes in the atmospheric boundary layers, including energy budget, radiation, soil heat transfer, humidity, viscous flows, turbulence, momentum and heat exchanges, evaporation, and marine atmospheric boundary layer.

Prerequisites: C or better in PHYS 201 and MATH 141.

Cross-listed course: GEOL 568

MSCI 574 - Marine Conservation Biology (3 Credits)

Exploration of how human activities affect marine natural populations, species, communities and ecosystems, including threats to biodiversity; approaches to marine conservation; and ecological and evolutionary responses to anthropogenic disturbance.

Prerequisites: BIOL 301.

Cross-listed course: BIOL 574

MSCI 575 - Marine Ecology (3 Credits)

Structure, dynamics, and interactions between populations and communities in marine ecosystems. Attendance at designated departmental seminars is required. Three lecture hours per week.

Prerequisites: CHEM 111 and BIOL 301 or MSCI 311.

Cross-listed course: BIOL 575

MSCI 575L - Marine Ecology Laboratory (1 Credit)

Laboratory and field exercises in coastal environments. Three hours per week plus field trips.

Prerequisite or Corequisite: MSCI 575 or BIOL 575.

Cross-listed course: BIOL 575L

MSCI 576 - Marine Fisheries Ecology (3 Credits)

Interdisciplinary examination of the distribution, reproduction, survival, and historical variation of the principal commercial marine fisheries.

Prerequisites: BIOL 301.

Cross-listed course: BIOL 576

MSCI 577 - Ecology of Coral Reefs (4 Credits)

Structure, productivity, and biodiversity of coral reefs, emphasizing their sensitivity, stability, and sustainability. Taught as an extended field experience with daily lectures and guided research activities.

Prerequisites: BIOL 301 or MSCI 311.

Cross-listed course: BIOL 577

MSCI 578 - Physiological and Pollution Ecology of Marine Organisms (3 Credits)

Functional adaptation of marine plants and animals to ecological stresses including pollution. Three lecture hours per week.

Prerequisites: MSCI 311 or equivalent.

MSCI 579 - Air-Sea Interaction (3 Credits)

The physical mechanism responsible for interaction between the ocean and the atmosphere and the influence of air-sea interaction on atmospheric and oceanic dynamics and thermodynamics on a wide variety of spatial/temporal scales.

Cross-listed course: GEOL 579

MSCI 580 - Satellite Oceanography (3 Credits)

This course provides knowledge of various techniques used in satellite remote sensing of the oceans. Key skills will be developed in satellite data processing, image analysis, and hands-on research.

Cross-listed course: GEOL 580

MSCI 581 - Estuarine Oceanography (3 Credits)

Estuarine kinematics and dynamics; classification of estuaries; estuarine circulation and mixing. Scheduled field trips are required.

Prerequisites: MSCI 314.

Cross-listed course: GEOL 581

MSCI 582 - Marine Hydrodynamics (3 Credits)

Basic principles of fluid statics and dynamics. Conservation of mass, momentum, and energy; viscosity, vorticity, and boundary layers with examples from the marine environment. Applications to and analysis of ocean currents and waves.

Prerequisites: C or better in MATH 241 and C or better in either PHYS 201 or PHYS 211.

Cross-listed course: GEOL 582

MSCI 583 - Geology and Geochemistry of Salt Marshes (3 Credits)

Geological and geochemical processes in salt marshes. Methods of geological research in marshes including instrumental techniques, sampling design, and data analysis. Two lectures per week plus four weekends of project oriented fieldwork and/or equivalent lab work. Scheduled field trips are required.

Cross-listed course: GEOL 583

MSCI 585 - Coastal Tropical Oceanography (4 Credits)

Descriptive oceanography of mangrove and coral reef coasts with emphasis on physical processes. Taught as an extended field experience with daily lectures and guided research activities.

Prerequisites: MSCI 312.

MSCI 590 - Beach-Dune Interactions (3 Credits)

Influence of wind on coastal systems, with emphasis on nearshore currents, sediment transport and bedforms, aeolian transport, and dunes. Minimum Junior standing required.

Cross-listed course: GEOG 590

MSCI 599 - Topics in Marine Science (1-3 Credits)

Current developments in marine science selected to meet faculty and student interests. Course content varies and will be announced by title in schedule of courses.

MSCI 624 - Aquatic Chemistry (3 Credits)

Study of the chemical reactions and processes affecting the distribution of chemical species in natural systems. Three lecture hours per week.

Prerequisite or Corequisite: CHEM 321, MATH 142.

Cross-listed course: CHEM 624

MSCI 627 - Marine Phytoplankton (3 Credits)

Examines the physiology and ecology of phytoplankton, including environmental controls on community composition, primary productivity, and detection and characterization of water quality (eutrophication) and harmful algal blooms.

Prerequisites: MSCI 102 or MSCI 450 or BIOL 450.

Cross-listed course: BIOL 627

MSCI 709 - Marine Data Science with R (3 Credits)

This course provides a hands-on, project-oriented investigation of current approaches for research in marine science, ecology and environmental science. Components of the course will include exploratory data analyses, statistics, graphics and the R programming language. Prior programming experience is beneficial, but not required.

Cross-listed course: ENVR 709

MSCI 711 - Paleoclimatology (3 Credits)

An overview of Earth's climate history during Cenozoic. Emphasis will be placed on Pleistocene glacial-interglacial climate variability and understanding the proxies used to reconstruct past climate changes.

Cross-listed course: GEOL 711

MSCI 716 - Eustasy and Global Variations in Sequence Stratigraphy (3 Credits)

Relationship of sequence stratigraphy to sea level variations, tectonics and sedimentation. Construction and analyses of paleogeographic maps, regional cross-sections, and chronostratigraphic charts.

Cross-listed course: GEOL 716

MSCI 717 - Organic Geochemistry (3 Credits)

Sources, transport, and fate of organic matter in natural environments including soils, riverine, estuarine, coastal and open ocean sediments and waters.

Prerequisites: GEOL 521/MSCI 521.

Cross-listed course: GEOL 717

MSCI 745 - Geological Oceanography (3 Credits)

A comprehensive study of the origin and development of the major structural features of the ocean basins and the continental margins. Discussion of the techniques used in obtaining geologic data and the interpretation of sedimentary processes, vulcanism, and the stratigraphy of the ocean basins.

MSCI 750 - Advanced Biological Oceanography (3 Credits)

Three lecture hours per week.

Prerequisites: BIOL 450/MSCI 450.

Cross-listed course: BIOL 750

MSCI 752 - Marine Biogeochemistry (3 Credits)

Biological, geological, and physical processes that influence the cycling of major bioactive elements (C, O, N, P, S) in marine waters and sediments.

Cross-listed course: BIOL 752

MSCI 754 - Oceanographic Techniques (1 Credit)

MSCI 755 - Marine Conservation and Environmental Health (3 Credits)
Explores the intersection between conservation and environmental health with a particular focus on coastal and marine case studies.

Cross-listed course: ENHS 755

MSCI 758 - Special Topics in Marine Sciences (1-3 Credits)

CL: 2020.

MSCI 767 - Ecological Modeling and Environmental Planning (4 Credits)

Concepts in systems ecology and ecological modeling. Emphasis on the use of models and computer simulations in examining environmental interactions, predicting environmental impact, and facilitating the process of environmental planning. Lab practice in model development and computer simulation analysis.

Prerequisites: MATH 111 or equivalent, ecology, ENHS 660.

Cross-listed course: BIOL 768, ENHS 767

MSCI 769 - Reproductive Ecology (3 Credits)

Theoretical aspects and examples of the variety of reproductive and life history patterns found in animals and plants as adaptations to various environmental constraints. Three lecture hours per week.

Prerequisites: BIOL 570.

Cross-listed course: BIOL 769

MSCI 777 - Current Topics in Marine Ecology for Teachers (3 Credits)

Primarily for teachers. Marine science materials with emphasis on coastal environments. Field exercises.

MSCI 778 - Current Topics in Marine Ecology for Teachers (3 Credits)

Primarily for teachers. Marine science materials with emphasis on coastal environments. Field exercises.

MSCI 781 - Physical Oceanography (3 Credits)

Geographic and hydrodynamic aspects of oceanography, with emphasis on estuaries. Physical properties of sea water and theories and methods involved in ocean currents, air-sea interaction, waves, and tides.

Cross-listed course: GEOL 781

MSCI 782 - Chemical Oceanography (3 Credits)

Chemical characteristics of sea water, distribution of properties, and chemical processes in the oceans, with emphasis on estuaries.

Cross-listed course: GEOL 782

MSCI 783 - Oceanographic Time Series Analysis (3 Credits)

Techniques in the analysis of oceanographic data sequences, including filtering techniques, fast Fourier transformers, and empirical orthogonal functions.

Cross-listed course: GEOL 783

MSCI 784 - Geophysical Fluid Dynamics (3 Credits)

Equations governing the large-scale dynamics of the atmosphere and ocean, rotational influence, shallow water equations, vorticity, quasi-geostrophic dynamics, Rossby waves, energy and enstrophy, and geostrophic turbulence.

Prerequisites: MATH 241 or ECIV 360 or GEOL 582/MSCI 582 or GEOL 781/MSCI 781.

Cross-listed course: GEOL 784

MSCI 785 - Atmospheric Dynamics (3 Credits)

Elementary applications of the basic equations, scale analysis, planetary boundary layer, atmospheric oscillations, synoptic and mesoscale systems, hydrodynamic instability, cyclogenesis, frontogenesis, energy cycle, momentum budget, and tropical motion systems.

Cross-listed course: GEOL 785

MSCI 790 - Directed Individual Studies in Marine Sciences (1-6 Credits)

Directed research topics to be individually assigned and supervised by graduate faculty.

MSCI 795 - Issues in Coastal Environmental Health (3 Credits)

Problems associated with coastal population growth and development. Emphasis is on the working group approach to ameliorating impacts on ecosystem and human health.

Cross-listed course: ENHS 795

MSCI 798 - Research in Marine Science (1-9 Credits)

In depth research methods and techniques in preparation of thesis or dissertation.

MSCI 799 - Thesis Preparation (1-9 Credits)

MSCI 800 - Marine Science Seminar (0 Credits)

Advanced topics in Marine Science research presented in Seminar format. Class meets weekly, every semester, during the Marine Science Program seminar.

MSCI 899 - Dissertation Preparation (1-12 Credits)