

MARINE SCIENCE (MASC)

MASC 51. First Year Seminar: Global Warming: Science, Social Impacts, Solutions. 3 Credits.

Students will examine evidence that human activity has caused global warming, investigate scientists' ability to predict climate change, and discuss the political and social dimensions of global climate change.

Gen Ed: PL, QI.

Grading status: Letter grade.

MASC 52. First-Year Seminar: Living with Our Oceans and Atmosphere. 3 Credits.

Modern theories of changing weather, severe weather events, oceanic hazards, interactions between the oceans and atmosphere, and changes that are linked to human activity.

Gen Ed: PL.

Grading status: Letter grade.

MASC 53. First-Year Seminar: The Ends of the Earth: Polar Oceanography and Exploration. 3 Credits.

What explains the "pull of the poles"? This seminar combines a modern survey of polar oceanography with historical views of early polar explorations, as reported by the explorers themselves.

Gen Ed: PL.

Grading status: Letter grade.

MASC 55. First-Year Seminar: Change in the Coastal Ocean. 3 Credits.

This course provides an opportunity to explore changes in marine and closely linked terrestrial environments caused by the interactions of fascinating oceanographic processes. Introductory presentations and discussions will focus on published works of active marine scientists who combine disciplinary training with knowledge and skills from other fields.

Gen Ed: PL.

Grading status: Letter grade.

MASC 57. First-Year Seminar: From "The Sound of Music" to "The Perfect Storm. 3 Credits.

Students will develop the conceptual framework necessary to understand waves of any kind, starting from laboratory observations. Honors version available

Gen Ed: PL, QI.

Grading status: Letter grade

Same as: MATH 63.

MASC 57H. First-Year Seminar: From "The Sound of Music" to "The Perfect Storm. 3 Credits.

Students will develop the conceptual framework necessary to understand waves of any kind, starting from laboratory observations.

Gen Ed: PL, QI.

Grading status: Letter grade

Same as: MATH 63H.

MASC 58. First-Year Seminar: Connections to the Sea: The Challenges Faced by Using and Living near Coastal In. 3 Credits.

This course explores the natural history of several inlets, impact of human intervention, and political/policy challenges faced; includes several group projects/presentations and a field trip to a coastal inlet.

Gen Ed: PL.

Grading status: Letter grade.

MASC 59. First-Year Seminar: Extreme Microorganisms: Pushing the Limits of Life on Earth and Beyond. 3 Credits.

This seminar focuses on some of the most extreme microorganisms on the planet, microorganisms that thrive without oxygen, under high temperatures (e.g., in pressurized water above the boiling point), and under chemical stress factors (high sulfide and heavy metal concentrations) that were once thought to be incompatible with life.

Gen Ed: PL.

Grading status: Letter grade.

MASC 89. First -Year Seminar: Special Topics. 3 Credits.

Special topics course. Content will vary each semester.

Repeat rules: May be repeated for credit; may be repeated in the same term for different topics; 6 total credits. 2 total completions.

Grading status: Letter grade.

MASC 101. The Marine Environment. 3 Credits.

Introduction to marine sciences emphasizing physical, chemical, biological, and geological phenomenon in oceanic and coastal environments. Human use of, and impact on, marine resources. Science majors should take MASC 401. Students may not receive credit for both MASC 101 and MASC 401.

Gen Ed: PL.

Grading status: Letter grade

Same as: GEOL 103.

MASC 108. Climate and Energy Transitions: Understanding the Forecasts. 4 Credits.

This course examines uncertainties in projecting future fossil fuel consumption and impact on global climate by quantifying how effectively alternative power-generation and energy-storage technologies can scale to meet needs in developing and developed nations, and by understanding past and present climates.

Gen Ed: PX, GL.

Grading status: Letter grade

Same as: GEOL 108, PHYS 108.

MASC 190. Special Topics in Marine Sciences. 3 Credits.

An undergraduate seminar course that is designed to be a participatory intellectual adventure on an advanced, emergent, and stimulating topic within a selected discipline in marine sciences.

Grading status: Letter grade.

MASC 220. North Carolina Estuaries: Environmental Processes and Problems. 3 Credits.

Natural processes and human impacts on estuarine systems using the Neuse River estuary as a case study. Course includes one week of intensive field work based at the Institute of Marine Sciences. A student may not receive credit for this course after receiving credit for ENEC 222.

Gen Ed: PX, EE- Field Work.

Grading status: Letter grade

Same as: ENEC 220.

MASC 223. Geology of Beaches and Coasts. 3 Credits.

Required preparation, one introductory geology course numbered below GEOL 202, except first-year seminar. Introduction to coastal processes, including waves, tidal currents, tectonics, climate, and human activity, and their influence on barrier islands, beaches, dunes, marshes, and estuaries. Involves a field trip to the Outer Banks of North Carolina.

Grading status: Letter grade

Same as: GEOL 223.

MASC 310. Our Changing Planet: Science, Social Impacts, Solutions. 3 Credits.

An overview of the scientific basis for global warming, current and future impacts on society, options for mitigation and adaptation, and the role of politics and the media.

Gen Ed: PL.

Grading status: Letter grade.

MASC 312. From the Equator to the Poles: Case Studies in Global Environmental Change. 3 Credits.

Case studies in environmental change, highlighting human and environmental dynamics in terrestrial and marine ecosystems on multiple spatial and temporal scales. Includes active-learning modules, group presentations, writing assignments.

Gen Ed: SS, GL.

Grading status: Letter grade.

MASC 314. Earth Systems in a Changing World. 3 Credits.

This course presents an integrated view of our planet, how it evolved during the past, why it has changed (and continues to change), and what makes Earth a habitable planet.

Grading status: Letter grade.

MASC 316. Coastal Environmental Change. 3 Credits.

An exploration of the large-scale evolution of coastal environments, including relevance of geologic setting, wave and sediment transport processes, the evolution of beach and barrier island morphology, and issues of coastal environmental management.

Requisites: Prerequisite, GEOL 101 or MASC 101 or MASC 401; permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade

Same as: GEOL 310, ENEC 310.

MASC 352. Marine Fisheries Ecology. 3 Credits.

Gives students a foundation in population biology and the ecological processes that influence populations of economically important fish and shellfish. Students will gain practical quantitative skills including statistical analyses, model development, and data visualization. Familiarity with introductory statistics concepts is preferred but not necessary.

Requisites: Prerequisite, MASC 101, 401, or ENEC 202.

Grading status: Letter grade

Same as: ENEC 352.

MASC 390. Special Topics in Marine Sciences (for Undergraduates). 1-4 Credits.

Special topics in marine sciences for undergraduate students.

Repeat rules: May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 3 total completions.

Grading status: Letter grade.

MASC 395. Undergraduate Research in Marine Sciences. 1-3 Credits.

Permission of a faculty research director. Directed readings with laboratory study on a selected topic.

Gen Ed: EE- Mentored Research.

Repeat rules: May be repeated for credit. 8 total credits. 4 total completions.

Grading status: Letter grade.

MASC 396. Independent Study in Marine Sciences. 3 Credits.

Permission of the instructor. Directed readings on a selected topic.

Repeat rules: May be repeated for credit; may be repeated in the same term for different topics; 6 total credits. 2 total completions.

Grading status: Letter grade.

MASC 401. Oceanography. 3 Credits.

Required preparation, major in a natural science or two courses in natural sciences. Studies origin of ocean basins, seawater chemistry and dynamics, biological communities, sedimentary record, and oceanographic history. Term paper. Students lacking science background should see MASC 101. Students may not receive credit for both MASC 101 and MASC 401.

Grading status: Letter grade

Same as: BIOL 350, ENVR 417, GEOL 403.

MASC 410. Earth Processes in Environmental Systems. 4 Credits.

Principles of geological and related Earth systems sciences are applied to analyses of environmental phenomena. The link between the lithosphere and other environmental compartments is explored through case studies of environmental issues. Three lecture hours and one laboratory hour a week.

Requisites: Prerequisites, CHEM 102, GEOL 200, MATH 231, and PHYS 115 or 119; permission of the instructor for students lacking the prerequisites.

Grading status: Letter grade

Same as: ENEC 410, GEOL 410.

MASC 411. Oceanic Processes in Environmental Systems. 4 Credits.

Principles of analysis of the ocean, coast, and estuarine environments and the processes that control these environments are applied to the analysis of environmental phenomena. Case studies of environmental issues. Three lecture hours and one laboratory hour a week.

Requisites: Prerequisites, BIOL 101, CHEM 102, ENEC 222, MATH 231, PHYS 115 or 119; permission of the instructor for students lacking the prerequisites.

Grading status: Letter grade

Same as: ENEC 411, GEOL 411.

MASC 415. Environmental Systems Modeling. 3 Credits.

This course explores principles and strategies for studying environmental phenomena, and presents methods for developing explanatory and predictive models of environmental systems, e.g., predator-prey, estuaries, greenhouse gases, and ecosystem material cycles.

Requisites: Prerequisite, MATH 383; pre- or corequisite, PHYS 115 or 118, and COMP 116.

Grading status: Letter grade

Same as: ENEC 415, GEOL 415.

MASC 432. Major World Rivers and Global Change: From Mountains to the Sea. 3 Credits.

What are the linkages between rivers and global change? This course examines the hydrological, geological and biogeochemical processes that control material flux from land to the oceans via rivers.

Grading status: Letter grade.

MASC 433. Wetland Hydrology. 3 Credits.

Study of wetland ecosystems with particular emphasis on hydrological functioning, the transition from terrestrial to aquatic systems, wetlands as filtration systems, and exchange between wetlands and other environments.

Grading status: Letter grade

Same as: ENEC 433.

MASC 434. Blue Carbon and Coastal Environments. 3 Credits.

Permission of the instructor is required. Readings and discussions about processes in traditional "Blue Carbon" environments (marshes, sea grass beds, and mangroves) and an exploration of carbon burial in other coastal ecosystems such as floodplains and oyster reefs.

Grading status: Letter grade.

MASC 440. Marine Ecology. 3 Credits.

Survey of the ecological processes that structure marine communities in a range of coastal habitats. Course emphasizes experimental approaches to addressing basic and applied problems in marine systems.

Requisites: Prerequisite, BIOL 201 or 475.

Gen Ed: PL.

Grading status: Letter grade

Same as: BIOL 462.

MASC 441. Marine Physiological Ecology. 3 Credits.

This course introduces students to the physiological, morphological, and behavioral factors employed by marine organisms to cope with their physical environment. Emphasis will be placed on the response of marine organisms to environmental factors such as seawater temperature, light, water salinity, ocean acidification, etc.

Grading status: Letter grade

Same as: ENEC 441.

MASC 442. Marine Biology. 3 Credits.

Recommended preparation, BIOL 201 or 475. A survey of plants and animals that live in the sea: characteristics of marine habitats, organisms, and the ecosystems will be emphasized. Marine environment, the organisms involved, and the ecological systems that sustain them.

Gen Ed: PL.

Grading status: Letter grade

Same as: BIOL 457.

MASC 443. Marine Microbiology. 3 Credits.

Restricted to junior or senior science majors or graduate students, with permission of the instructor. Seminar class focuses on the primary research literature. Physiology of marine microorganisms, microbial diversity and ecology of the marine environment, biogeochemical processes catalyzed by marine microorganisms.

Gen Ed: PL.

Grading status: Letter grade.

MASC 444. Marine Phytoplankton. 3 Credits.

Permission of the instructor. For junior and senior science majors or graduate students. Biology of marine photosynthetic protists and cyanobacteria. Phytoplankton evolution, biodiversity, structure, function, biogeochemical cycles and genomics. Harmful algal blooms, commercial products, and climate change. Three lecture/practical session hours per week.

Grading status: Letter grade

Same as: ENEC 444, BIOL 456.

MASC 445. Marine Invertebrate Biology. 4 Credits.

See BIOL 475 for description.

Grading status: Letter grade.

MASC 446. Marine Microbial Symbioses: Exploring How Microbial Interactions Affect Ecosystems and Human Health. 3 Credits.

Course material covers host-microbe and microbe-microbe interactions found in marine ecosystems, including beneficial and parasitic relationships among viruses, microbes, marine animals, and humans. Limited to upper-level undergraduate science majors and graduate students.

Gen Ed: PL.

Grading status: Letter grade

Same as: BIOL 452.

MASC 447. Microbial Ecological Genomics. 3 Credits.

Permission of the instructor. For junior and senior science majors and graduate students. Active learning class focused on sequencing and bioinformatic analysis of microbial genomes to identify their ecological function. Topics include sequencing technologies, genome assembly and analysis, command line, bioinformatic tools, and genes mediating microbial physiology and metabolism in natural ecosystems.

Gen Ed: PL.

Grading status: Letter grade.

MASC 448. Coastal and Estuarine Ecology. 4 Credits.

A field-intensive study of the ecology of marine organisms and their interactions with their environment, including commercially important organisms. Laboratory/recitation/field work is included and contributes two credit hours to the course.

Requisites: Prerequisites, CHEM 102 and MATH 231.

Grading status: Letter grade

Same as: ENEC 448.

MASC 450. Biogeochemical Processes. 4 Credits.

Principles of chemistry, biology, and geology are applied to analysis of the fate and transport of materials in environmental systems, with an emphasis on those materials that form the most significant cycles. Three lecture hours and one laboratory hour a week.

Requisites: Prerequisites, MATH 231, and PHYS 114 or 118; permission of the instructor for students lacking the prerequisites.

Gen Ed: PL.

Grading status: Letter grade

Same as: ENEC 450, GEOL 450.

MASC 455. Geochemistry. 3 Credits.

Required preparation, one introductory geology course. Introduction to the application of chemical principles to geological problems. Topics include thermodynamics, kinetics, and isotope geochemistry. Previously offered as GEOL 512/MASC 553.

Requisites: Prerequisites, CHEM 102 and MATH 231; permission of the instructor for students lacking the prerequisites.

Gen Ed: QI.

Grading status: Letter grade

Same as: GEOL 405.

MASC 460. Fluid Dynamics of the Environment. 3 Credits.

Principles and applications of fluid dynamics to flows of air and water in the natural environment. Conservation of momentum, mass, and energy applied to lakes, rivers, estuaries, and the coastal ocean. Dimensional analysis and scaling emphasized to promote problem-solving skills.

Requisites: Prerequisite, MATH 232; permission of the instructor for students lacking the prerequisite.

Gen Ed: QI.

Grading status: Letter grade.

MASC 470. Estuarine and Coastal Marine Science. 4 Credits.

For graduate students; undergraduate students should take ENEC 222 or have permission of the instructor. Introduction to estuarine environments: geomorphology, physical circulation, nutrient loading, primary and secondary production, carbon and nitrogen cycling, benthic processes and sedimentation. Considers human impacts on coastal systems, emphasizing North Carolina estuaries.

Gen Ed: PL, QI.

Grading status: Letter grade.

MASC 471. Human Impacts on Estuarine Ecosystems. 4 Credits.

A cohesive examination of the human impacts on biological processes in estuarine ecosystems. Laboratory/recitation/field work is included and contributes two credit hours to the course.

Requisites: Prerequisites, CHEM 102 and MATH 231.

Grading status: Letter grade

Same as: ENEC 471.

MASC 472. Barrier Island Ecology and Geology. 6 Credits.

Recommended preparation, one introductory geology course. An integration of barrier island plant and animal ecology within the context of physical processes and geomorphological change. Emphasis on management and impact of human interference with natural processes.

Gen Ed: PL, EE- Field Work.

Grading status: Letter grade.

MASC 473. The Changing Coasts of Carolina. 3 Credits.

A rigorous combination of field work, lab work, and colorful, original contemporary writing on the natural world will help tell the story of our many, evolving North Carolina coasts. Combining marine science and the creative literary arts, this immersive course will explore issues of change over many eras. This combination of social, cultural, and scientific observation will lead to imaginatively constructed, well-written non-fiction reportage about one of North America's most productive, compelling, and challenging regions.

Gen Ed: CI, EE- Field Work.

Grading status: Letter grade

Same as: ENGL 473.

MASC 480. Modeling of Marine and Earth Systems. 1-3 Credits.

Mathematical modeling of dynamic systems, linear and nonlinear. The fundamental budget equation. Case studies in modeling transport, biogeochemical processes, population dynamics. Analytical and numerical techniques; chaos theory; fractal geometry.

Requisites: Prerequisite, MATH 232; permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade

Same as: GEOL 480, ENVR 480.

MASC 483. Geologic and Oceanographic Applications of Geographical Information Systems. 4 Credits.

Required preparation, four GEOL courses or permission of the instructor. Focus is on applying GIS concepts and techniques to mining and petroleum geology, resource assessment, hydrogeology, coastal and marine geology, physical oceanography, engineering geology, and a geologic perspective on land use. Three lecture and two laboratory hours a week.

Grading status: Letter grade

Same as: GEOL 483.

MASC 490. Special Topics in Marine Sciences for Undergraduates and Graduates. 1-3 Credits.

Directed readings, laboratory, and/or field study of marine science topics not covered in scheduled courses.

Repeat rules: May be repeated for credit. 12 total credits. 4 total completions.

Grading status: Letter grade.

MASC 503. Marine Geology. 4 Credits.

For graduate students; undergraduates need permission of the instructor. Investigates formation of the oceans, plate tectonics, carbonate reefs and platforms, sediment transport from the land to deep-sea fans, glacial-marine geology, marine records of changes in sea level and climate, and the evolution of barrier islands, estuaries, and deltas. Mandatory weekend field trip to the Southern Outer Banks.

Gen Ed: PL.

Grading status: Letter grade

Same as: GEOL 503.

MASC 504. Biological Oceanography. 4 Credits.

For graduate students; undergraduates need permission of the instructor. Marine ecosystem processes pertaining to the structure, function, and ecological interactions of biological communities; management of biological resources; taxonomy and natural history of pelagic and benthic marine organisms. Three lecture and one recitation hours per week. Two mandatory weekend fieldtrips.

Gen Ed: PL.

Grading status: Letter grade

Same as: BIOL 657, ENVR 520.

MASC 505. Chemical Oceanography. 4 Credits.

Graduate students only; undergraduates must have permission of the instructor. Overview of chemical processes in the ocean. Topics include physical chemistry of seawater, major element cycles, hydrothermal vents, geochemical tracers, air-sea gas exchange, particle transport, sedimentary processes, and marine organic geochemistry. Three lecture and two recitation hours per week.

Gen Ed: PL.

Grading status: Letter grade

Same as: ENVR 505, GEOL 505.

MASC 506. Physical Oceanography. 4 Credits.

For graduate students; undergraduates need permission of the instructor. Descriptive oceanography, large-scale wind-driven and thermohaline circulations, ocean dynamics, regional and nearshore/estuarine physical processes, waves, tides. Three lecture and one recitation hour per week.

Gen Ed: PL.

Grading status: Letter grade

Same as: GEOL 506.

MASC 550. Biogeochemical Cycling. 3 Credits.

Biogeochemical cycling explores interfaces of marine, aquatic, atmospheric, and geological sciences emphasizing processes controlling chemical distributions in sediments, fresh and salt water, the atmosphere, and fluxes among these reservoirs.

Requisites: Prerequisites, ENVR 421; GEOL 405, 436, 655; MASC 440, 505; or permission of the instructor.

Gen Ed: PL, CI.

Grading status: Letter grade

Same as: GEOL 550.

MASC 552. Organic Geochemistry. 3 Credits.

Recommended preparation, CHEM 261 or MASC 505, and one additional ENVR, GEOL, or MASC course above 400. Sources, transformations, and fate of natural organic matter in marine environments. Emphasis on interplay of chemical, biological, and physical processes that affect organic matter composition, distribution, and turnover.

Gen Ed: PL.

Grading status: Letter grade

Same as: GEOL 552, ENVR 552.

MASC 560. Fluid Dynamics. 3 Credits.

The physical properties of fluids, kinematics, governing equations, viscous incompressible flow, vorticity dynamics, boundary layers, irrotational incompressible flow.

Requisites: Prerequisite, PHYS 401; permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade

Same as: ENVR 452, GEOL 560, PHYS 660.

MASC 561. Time Series and Spatial Data Analysis. 3 Credits.

Three components: statistics and probability, time series analysis, and spatial data analysis. Harmonic analysis, nonparametric spectral estimation, filtering, objective analysis, empirical orthogonal functions.

Requisites: Prerequisite, MATH 233; permission of the instructor for students lacking the prerequisite.

Gen Ed: PL, QI.

Grading status: Letter grade.

MASC 562. Turbulent Boundary Layers. 3 Credits.

Turbulence and transport in near-bottom boundary regions. Turbulence and mixing theory in boundary layers. Field deployment and recovery of turbulence measuring instruments. Data analysis from turbulence measurements.

Requisites: Prerequisite, MASC 506 or 560; permission of the instructor for students lacking the prerequisite.

Gen Ed: PL, QI.

Grading status: Letter grade.

MASC 563. Descriptive Physical Oceanography. 3 Credits.

Observed structure of the large-scale and mesoscale ocean circulation and its variability, based on modern observations. In-situ and remote sensing techniques, hydrographic structure, circulation patterns, ocean-atmosphere interactions.

Requisites: Prerequisite, MASC 506; permission of the instructor for students lacking the prerequisite.

Gen Ed: PL.

Grading status: Letter grade

Same as: GEOL 563.

MASC 705. How to Give a Seminar. 1 Credit.

Discussion of methods and strategies for giving effective technical presentations. Topics will include seminar structure, use of visual aids, personal and professional presentation, and responding to questions.

Grading status: Letter grade.

MASC 706. Student Interdisciplinary Seminar. 1 Credit.

Marine Sciences graduate students will prepare and present a seminar on an interdisciplinary topic from contemporary research in marine systems.

Requisites: Prerequisite, MASC 705.

Grading status: Letter grade.

MASC 730. Advanced Coastal Environmental Change. 3 Credits.

Focuses on biological-physical couplings that shape coastal environments (i.e. coastal 'ecomorphodynamics') and determine how these environments change with climate and land use. Environments include: barrier islands, open ocean coastlines, and tidal wetlands. Grading based on presentations, participation, and a research proposal.

Requisites: Prerequisites, GEOL 417, 502, or 503; permission of the instructor for students lacking the prerequisites.

Grading status: Letter grade

Same as: GEOL 710, ENEC 710.

MASC 741. Seminar in Marine Biology. 2 Credits.

Discussion of selected literature in the field of marine biology, ecology, and evolution.

Grading status: Letter grade.

MASC 742. Molecular Population Biology. 4 Credits.

Hands-on training, experience, and discussion of the application of molecular genetic tools to questions of ecology, evolution, systematics, and conservation.

Requisites: Prerequisite, BIOL 471; Permission of the instructor for students lacking the prerequisites.

Grading status: Letter grade

Same as: BIOL 758.

MASC 750. Modeling Diagenetic Processes. 3 Credits.

An introduction to the theory and application of modeling biogeochemical processes in sediments. Diagenetic theory, numerical techniques, and examples of recently developed sediment models. Three lecture hours a week.

Requisites: Prerequisite, MASC 480; Permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade.

MASC 761. Geophysical Fluid Dynamics. 3 Credits.

Momentum equations in a rotating reference frame, vorticity, potential vorticity, circulation, the shallow water model, Rossby and Kelvin waves, the Ekman layer. Three lecture hours a week.

Requisites: Prerequisite, MASC 560 or MATH 528; permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade.

MASC 762. Ocean Circulation Theory. 3 Credits.

Theories, models of large-scale dynamics of ocean circulation. Potential vorticity, quasi-geostrophy, instabilities.

Requisites: Prerequisite, MASC 506 or 560, or MATH 529; permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade.

MASC 763. Coastal Circulation. 3 Credits.

Dynamics of the coastal ocean. Shallow water equations, boundary layer and long wave theory, wind driven circulation, fronts, estuaries.

Requisites: Prerequisite, MASC 506 or 560, or MATH 529; permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade.

MASC 764. Ocean Circulation Modeling. 3 Credits.

Computational methods used in modeling oceanic circulation. Numerical solution of equations governing mass, momentum, and energy equations.

Requisites: Prerequisite, MASC 506 or MATH 529; permission of the instructor for students lacking the prerequisite.

Grading status: Letter grade.

MASC 765. Small-Scale Physics of the Ocean. 3 Credits.

Physics of sub-mesoscale processes in the ocean. Nonequilibrium thermodynamics. Air-sea interaction. Mixing in the ocean boundary layer, convection, double diffusion. Near-inertial and high frequency internal waves. Three lecture hours a week.

Requisites: Prerequisites, MASC 506 and 560.

Grading status: Letter grade.

MASC 781. Numerical ODE/PDE, I. 3 Credits.

Single, multistep methods for ODEs: stability regions, the root condition; stiff systems, backward difference formulas; two-point BVPs; stability theory; finite difference methods for linear advection diffusion equations.

Requisites: Prerequisites, MATH 661 and 662.

Grading status: Letter grade

Same as: MATH 761, ENVR 761.

MASC 782. Numerical ODE/PDE, II. 3 Credits.

Elliptic equation methods (finite differences, elements, integral equations); hyperbolic conservation law methods (Lax-Friedrich, characteristics, entropy condition, shock tracking/capturing); spectral, pseudo-spectral methods; particle methods, fast summation, fast multipole/vortex methods.

Requisites: Prerequisite, MATH 761.

Grading status: Letter grade

Same as: MATH 762, ENVR 762.

MASC 783. Mathematical Modeling I. 3 Credits.

Nondimensionalization and identification of leading order physical effects with respect to relevant scales and phenomena; derivation of classical models of fluid mechanics (lubrication, slender filament, thin films, Stokes flow); derivation of weakly nonlinear envelope equations. Fall.

Requisites: Prerequisites, MATH 661, 662, 668, and 669.

Grading status: Letter grade

Same as: MATH 768, ENVR 763.

MASC 784. Mathematical Modeling II. 3 Credits.

Current models in science and technology: topics ranging from material science applications (e.g., flow of polymers and LCPs); geophysical applications (e.g., ocean circulation, quasi-geostrophic models, atmospheric vortices).

Requisites: Prerequisites, MATH 661, 662, 668, and 669.

Grading status: Letter grade

Same as: MATH 769, ENVR 764.

MASC 799. Experimental Graduate. 1-9 Credits.

Experimental graduate level courses as offered by the Department.

Repeat rules: May be repeated for credit; may be repeated in the same term for different topics; 9 total credits. 1 total completions.

Grading status: Letter grade.

MASC 893. Special Topics in Marine Geology. 1-9 Credits.

Special topics courses in Marine Geology as offered by Department.

Repeat rules: May be repeated for credit; may be repeated in the same term for different topics; 9 total credits. 1 total completions.

Grading status: Letter grade.

MASC 894. Special Topics in Biological Oceanography. 1-9 Credits.

Special topics courses in Biological Oceanography as offered by Department.

Repeat rules: May be repeated for credit; may be repeated in the same term for different topics; 9 total credits. 1 total completions.

Grading status: Letter grade.

MASC 895. Special Topics in Physical Oceanography. 1-9 Credits.

Special topics courses in Physical Oceanography as offered by Department.

Repeat rules: May be repeated for credit; may be repeated in the same term for different topics; 9 total credits. 1 total completions.

Grading status: Letter grade.

MASC 896. Special Topics in Chemical Oceanography. 1-9 Credits.

Special topics courses in Chemical Oceanography as offered by Department.

Repeat rules: May be repeated for credit; may be repeated in the same term for different topics; 9 total credits. 1 total completions.

Grading status: Letter grade.

MASC 897. Special Topics in Marine Sciences. 1-9 Credits.

Special topics courses in Marine Sciences as offered by Department.

Repeat rules: May be repeated for credit; may be repeated in the same term for different topics; 9 total credits. 1 total completions.

Grading status: Letter grade.

MASC 940. Research in Marine Sciences. 2-21 Credits.**MASC 993. Master's Research and Thesis. 3 Credits.****MASC 994. Doctoral Research and Dissertation. 3 Credits.**