

OCEANOGRAPHY (OC)

OC 103. *EXPLORING THE DEEP. GEOGRAPHY OF THE WORLD'S OCEANS. (4 Credits)

Introduces non-science students to the oceans, including marine geology and chemistry, ocean currents, coastal and biological processes. Field trip required, transportation fee charged. Lec/lab. (Bacc Core Course)

Attributes: CPPS – Core, Pers, Physical Science

OC 199. SPECIAL TOPICS IN OCEANOGRAPHY. (1-4 Credits)

Introduction to topics of current interest in oceanography for lower-division undergraduates. May be repeated for credit when topic varies. *This course is repeatable for 16 credits.*

OC 201. *OCEANOGRAPHY. (4 Credits)

Plate tectonics and the geological structure of ocean basins; physical and chemical properties of seawater; Earth's energy budget; large-scale circulation of the atmosphere and ocean; marine sediment properties and transport; Earth history recorded in marine sediments; the carbon cycle in the atmosphere and sea; and the ecology of pelagic and benthic systems. Lec/lab. (Bacc Core Course)

Attributes: CPPS – Core, Pers, Physical Science

OC 295. INTRODUCTION TO FIELD OCEANOGRAPHY. (3 Credits)

One-week course taught during Spring Break at Hatfield Marine Science Center, with ten hours of preparatory meetings on the Corvallis campus. Collect oceanographic data and samples from ships and coastal marine habitats and conduct preliminary analysis of data and samples. Serves as an introduction to upper-division course work in ocean science. Field trip(s) required; transportation fee charged.

Prerequisites: OC 201 with D- or better or OC 332 with D- or better or OC 332H with D- or better

OC 332. COASTAL OCEANOGRAPHY. (3 Credits)

Physics, geology, biology and hydrology of coastal oceans. How coastal waters respond to forcing by heating, cooling, winds, tides, waves, rain, evaporation, river runoff and freezing. Geography and geology of coastlines: erosion and deposition processes, beach dynamics. Coastal equilibrium cells as sources and sinks of sediment. Rocky shore, beach, mudflat, estuarine, and coastal biotic communities; animal migrations. Law of the Sea rights and responsibilities of coastal states. Fisheries and mariculture in coastal seas. Pollution and coastal ocean resources. Using a matrix to define environmental problems; pathways that pollutants take through the coastal ecosystem. Offered annually.

OC 333. OCEANS, COASTS, AND PEOPLE. (3 Credits)

Contemporary issues related to human interactions with the oceans and coastal zones, including living and energy resources, geohazards and impacts of global change. Content presented in lectures, readings and group discussions, with project oral presentations.

Recommended: OC 201

OC 334. ^POLAR OCEANOGRAPHY. (3 Credits)

Explores the physical, chemical and biological oceanography of the Arctic and Antarctic and examines the impacts of man's activities both directly through resource utilization, and indirectly through climate change. Introduction to polar oceanography through a series of lectures, interactive classes, written assignments and a case study. (Writing Intensive Course)

Attributes: CWIC – Core, Skills, WIC

Prerequisites: OC 201 with D- or better

OC 399. SPECIAL TOPICS IN OCEANOGRAPHY. (1-4 Credits)

Equivalent to: OC 399H

This course is repeatable for 16 credits.

OC 399H. SPECIAL TOPICS IN OCEANOGRAPHY. (1-4 Credits)

Attributes: HNRS – Honors Course Designator

Equivalent to: OC 399

This course is repeatable for 16 credits.

OC 401. RESEARCH PROJECTS. (1-16 Credits)

Field and laboratory research in oceanography for undergraduates, resulting in a written report.

This course is repeatable for 24 credits.

OC 403. THESIS. (1-16 Credits)

Independent, original study that culminates in a senior thesis. Faculty sponsor must be prearranged. Graded P/N.

This course is repeatable for 24 credits.

OC 405. READING AND CONFERENCE. (1-4 Credits)

Independent library research and reading in specialized topics in oceanography for undergraduates, guided by discussions in conferences with faculty. A written report may be required.

This course is repeatable for 16 credits.

OC 407. SEMINAR. (1-3 Credits)

Undergraduate seminar on current developments in the oceanographic research literature, with student presentations and group discussions. A written report may be required.

Equivalent to: OC 407H

This course is repeatable for 12 credits.

OC 407H. SEMINAR. (1-3 Credits)

Undergraduate seminar on current developments in the oceanographic research literature, with student presentations and group discussions. A written report may be required.

Attributes: HNRS – Honors Course Designator

Equivalent to: OC 407

This course is repeatable for 12 credits.

OC 410. INTERNSHIP. (1-16 Credits)

Pre-career professional experience under joint faculty and employer supervision. Graded P/N.

This course is repeatable for 48 credits.

Recommended: 12 credits of upper-division college courses

OC 430. PRINCIPLES OF PHYSICAL OCEANOGRAPHY. (4 Credits)

Fundamental principles of physical oceanography; conservation of mass, heat, momentum and vorticity; equations governing motion in the ocean; geostrophy; planetary boundary layers; wind-driven and thermohaline circulation. Descriptive oceanography; application of the fundamental principles to the ocean; examination of the major current systems; water mass analysis. Offered annually.

Recommended: One year each of college physics and college calculus.

OC 433. COASTAL AND ESTUARINE OCEANOGRAPHY. (3 Credits)

Circulation of the coastal ocean including continental shelf circulation, upwelling, coastal jets, undercurrents, coastal-trapped waves. Fundamentals of surface waves and tides; tsunamis, wind generation, breaking waves. Estuary classification and circulation patterns; shallow-water processes and beach morphology. Offered alternate years.

Recommended: One year of college physics and one year of calculus.

OC 434. ESTUARINE ECOLOGY. (4 Credits)

Integrated and synthetic training in the ecological processes of estuarine environments, with emphases on ecological interactions among organisms and the biogeochemical cycling of carbon and nitrogen. Topics include geomorphology, estuarine physics and chemistry, primary and secondary producers, ecosystem metabolism, element cycling, food webs, fisheries, restoration management, and impacts of climate. Field trip required, transportation fee charged. CROSSLISTED as FW 434/ FW 534. Offered on Corvallis campus via interactive video from HMSC campus.

Equivalent to: FW 434

OC 440. BIOLOGICAL OCEANOGRAPHY. (4 Credits)

An advanced examination of the ocean as an ecosystem with emphasis on the processes affecting the production and structure of oceanic communities. Starting with the physical and chemical characteristics of the ocean environment, lectures and labs examine the flow of energy and matter from primary producers through primary consumers up to higher trophic levels. Microbial and benthic processes are examined. Current topics, such as hypoxia, ocean acidification and harmful algal blooms are discussed. Lec/lab.

Prerequisites: OC 201 with C- or better

Recommended: Two terms of college-level biology

OC 449. ECOLOGICAL THEORIES IN BIOLOGICAL AND FISHERIES OCEANOGRAPHY DATA. (4 Credits)

Students will learn the ecological theories applied in fisheries oceanography research and analytical techniques used to quantify fisheries oceanography processes. The lecture and lab sessions will be presented in the context of fundamental ecological research, including effects of environmental and climate variability on production and distribution of species and communities. A specific emphasis is toward analyses of large spatio-temporal data. Lec/Lab.

Prerequisites: (MTH 252 with C or better or MTH 252H with C or better or MTH 228 with C or better) and (ST 351 [C] or ST 351H [C]) and (OC 440 (may be taken concurrently) [C] or BI 370 [C] or BI 370H [C])

OC 450. CHEMICAL OCEANOGRAPHY. (4 Credits)

Chemical properties and processes in the oceans. Composition, origin and evolution of sea water; thermodynamic and kinetic predictions for reactions in sea water; major and minor element reservoirs and fluxes; vertical and horizontal transport of materials; isotopic clocks and tracers; nutrients; chemical processes and fluxes across major marine interfaces, including estuaries, atmosphere, sediments, suspended particles and hydrothermal systems. Lec/Lab.

Prerequisites: CH 122 with D- or better or CH 232 with D- or better or CH 232H with D- or better

Recommended: one year of college-level general chemistry.

OC 460. GEOLOGICAL OCEANOGRAPHY. (3 Credits)

Structure of ocean basins, plate tectonics and sea floor spreading, marine sedimentation, history of ocean basins, and analysis of geological and geophysical data. Offered annually.

Recommended: One year each of physics and chemistry or science background.

OC 499. SPECIAL TOPICS IN OCEANOGRAPHY. (0-4 Credits)

Subjects of current interest in oceanography, not covered in depth in other courses. May be repeated for credit when topic varies.

This course is repeatable for 16 credits.

OC 501. RESEARCH. (1-16 Credits)

Original research work that will not be part of the data used in a thesis. Graded P/N.

This course is repeatable for 24 credits.

OC 503. THESIS. (1-16 Credits)

Thesis research and writing.

This course is repeatable for 999 credits.

OC 505. READING AND CONFERENCE. (1-16 Credits)

Independent reading and library research on specialized topics in oceanography, guided by discussions with supervising faculty. A written report may be required.

This course is repeatable for 16 credits.

OC 506. PROJECTS. (1-16 Credits)

This course is repeatable for 72 credits.

OC 507. SEMINAR. (1-3 Credits)

Student presentations and discussions of current research literature or personal research results. Original research presentations by visiting scientists, OSU faculty and graduate students presenting final thesis results. Other sections and specific topics by arrangement.

This course is repeatable for 48 credits.

OC 508. WORKSHOP. (1-16 Credits)

This course is repeatable for 24 credits.

OC 512. BASIC MATLAB FOR ENVIRONMENTAL SCIENTISTS AND ENGINEERS. (2 Credits)

MATLAB desktop environment will be introduced and basic programming and data analysis skills will be developed, with an emphasis on writing optimized routines to analyze data sets utilizing matrix algebra and vectorization of functions. Basic graphics and visualization will be covered, including two-dimensional and three-dimensional graphing, contouring and movies.

OC 515. OREGON COAST MATH CAMP. (3 Credits)

Selected topics from differential calculus, integral calculus, ordinary and partial differential equations, statistics, linear algebra and vector calculus. Two-week course taught at Hatfield Marine Science Center in Newport, Oregon, before fall term begins. Graded P/N.

Recommended: Differential and integral calculus and linear algebra

OC 521. APPLICATIONS IN OCEAN ECOLOGY AND BIOGEOCHEMISTRY. (4 Credits)

Methodological underpinnings of marine ecology and biogeochemistry. Students will learn about both new and traditional methods of seawater analysis and biological rate determinations. They will evaluate methods by analyzing observations and samples, and assessing the interpretive effectiveness of approaches. Lec/lab.

Prerequisites: OEAS 540 with C or better

Corequisites: OC 522, OC 523

OC 522. OCEAN BIOGEOCHEMICAL DYNAMICS. (4 Credits)

Examines what keeps ocean systems in balance, and determines their response to perturbation. The course relies on connections between physical transport and biogeochemical reaction rates and energetics, taught from the perspective of key ocean biogeochemical cycles.

Corequisites: OC 521, OC 523

OC 523. OCEAN ECOLOGICAL DYNAMICS. (4 Credits)

Major characteristics of ocean biota and ocean ecosystems. Main themes will be centered on the bioenergetics of marine systems at levels ranging from the individual to ocean biomes, and on how ocean biota facilitates diverse marine biogeochemical processes. Lec/rec.

OC 528. MICROPROBE ANALYSIS. (3 Credits)

Theory and application of electron microprobe analysis to problems in geology, engineering, chemistry, physics, and biology.

OC 533. COASTAL AND ESTUARINE OCEANOGRAPHY. (3 Credits)

Circulation of the coastal ocean including continental shelf circulation, upwelling, coastal jets, undercurrents, coastal-trapped waves. Fundamentals of surface waves and tides; tsunamis, wind generation, breaking waves; shallow-water processes and beach morphology. Offered alternate years.

Recommended: One year of college physics and one year of calculus.

OC 534. ESTUARINE ECOLOGY. (4 Credits)

Integrated and synthetic training in the ecological processes of estuarine environments, with emphases on ecological interactions among organisms and the biogeochemical cycling of carbon and nitrogen. Topics include geomorphology, estuarine physics and chemistry, primary and secondary producers, ecosystem metabolism, element cycling, food webs, fisheries, restoration management, and impacts of climate. Field trip required, transportation fee charged. CROSSLISTED as FW 434/ FW 534.

Equivalent to: FW 534

OC 549. ECOLOGICAL THEORIES IN BIOLOGICAL AND FISHERIES OCEANOGRAPHY DATA. (4 Credits)

Students will learn the ecological theories applied in fisheries oceanography research and analytical techniques used to quantify fisheries oceanography processes. The lecture and lab sessions will be presented in the context of fundamental ecological research, including effects of environmental and climate variability on production and distribution of species and communities. A specific emphasis is toward analyses of large spatio-temporal data. Lec/Lab.

Recommended: (MTH 252 or MTH 252H or MTH 228) and (ST 351 or ST 351H) and (OC 440 or BI 370 or BI 370H)

OC 561. IGNEOUS AND TECTONIC PROCESSES IN THE OCEAN. (3 Credits)

An integrated view of the igneous and tectonic processes responsible for the formation and evolution of the ocean basins. The course is organized by tectonic environment including ridge crest, ridge flank, ocean basins, seamounts, and active and passive margins.

Recommended: One year each physics, calculus and geology.

OC 562. SEDIMENTARY PROCESSES IN THE OCEAN BASINS. (3 Credits)

An integrated view of sediment processes in the ocean basins from a source to sink perspective, with a special emphasis on the interpretation of the historical record.

Recommended: OC 550 and one year each physics and calculus and geology.

OC 574. EARLY LIFE HISTORY OF FISHES. (4 Credits)

Overview of diversity of development patterns in fishes; emphasis on morphology, life history, and evolution. Offered alternate years. CROSSLISTED as FW 574.

Equivalent to: FW 574

Recommended: FW 315

OC 599. SPECIAL TOPICS IN OCEANOGRAPHY. (0-4 Credits)

Subjects of current interest in oceanography, not covered in depth in other courses. May be repeated for credit when topic varies.

This course is repeatable for 12 credits.

OC 601. RESEARCH. (1-16 Credits)

Original research work that will not be part of the data used in a thesis. Graded P/N.

This course is repeatable for 36 credits.

OC 603. THESIS. (1-16 Credits)

Thesis research and writing.

This course is repeatable for 999 credits.

OC 605. READING AND CONFERENCE. (1-16 Credits)

Independent reading and library research on specialized topics in oceanography, guided by discussions with supervising faculty. A written report may be required.

This course is repeatable for 16 credits.

OC 606. PROJECTS. (1-16 Credits)

This course is repeatable for 84 credits.

OC 607. SEMINAR. (1-3 Credits)

Student presentations and discussion of current research literature or personal research results. Original research presentations by visiting scientists, OSU faculty and graduate students presenting final thesis results. Other sections and specific topics by arrangement.

This course is repeatable for 48 credits.

OC 608. WORKSHOP. (1-16 Credits)

This course is repeatable for 24 credits.

OC 630. OCEAN WAVE MECHANICS I. (3 Credits)

Linear wave boundary value problem formulation and solution, water particle kinematics, shoaling, refraction, diffraction, and reflection. Linear long wave theory with applications to tides, seiche, and storm surge. CROSSLISTED as CE 630. Lec/lab.

Equivalent to: CE 630

OC 631. OCEAN WAVE MECHANICS II. (3 Credits)

Second in the sequence of ocean engineering wave mechanics, covers the following topics: introduction to long wave theory, wave superposition, wave height distribution, and the wind-wave spectrum, introduction to wave forces, and basic nonlinear properties of water waves. May include additional selected topic in wave mechanics. CROSSLISTED as CE 631.

Prerequisites: CE 630 with C or better or OC 630 with C or better

Equivalent to: CE 631

OC 634. LONG WAVE MECHANICS. (3 Credits)

Theory of long waves. Depth-integrated Euler's equation and its jump conditions. Evolution equations and their solutions. Nonlinear shallow-water waves, the Korteweg-deVries equation and Boussinesq equation. Boundary-layer effects. Shallow-water waves on beaches. Applications of the fundamentals to problems of tsunamis. CROSSLISTED as CE 634.

Prerequisites: OC 630 with C or better and CE 631 [C]

Equivalent to: CE 634

Recommended: OC 670

OC 635. APPLIED MODELING OF NEARSHORE PROCESSES. (4 Credits)

An introduction to numerical modeling of the nearshore ocean, providing hands-on experience with state-of-the-art numerical models for wave propagation, nearshore circulation, planform shoreline evolution and bathymetric profile evolution. Focuses on review of model requirements, detailed study of several specific models for several domains of interest, application to coastal phenomena, interpretation of model results. Lec/lab. Offered alternate years. CROSSLISTED as CE 635.

Equivalent to: CE 635

OC 646. PHYSICAL/BIOLOGICAL INTERACTIONS IN THE UPPER OCEAN. (4 Credits)

Variability in physical oceanic processes in the upper ocean and relationship to spatial and temporal variations in biomass, growth rates, and other biological patterns in the organisms of ocean surface waters. The relationship between variability in ocean physical phenomena and ecosystem dynamics, including the requirements of sampling design for upper ocean ecological studies. Time and space scales of physical and biological phenomena in the upper ocean. Offered alternate years. Offered alternate years, typically fall term.

Prerequisites: OEAS 530 with C or better and OEAS 540 [C]

OC 649. SPECIAL TOPICS IN BIOLOGICAL OCEANOGRAPHY. (1-4 Credits)

Special topics of current interest in biological oceanography not covered in detail in other courses. May be repeated for credit when topic varies.

This course is repeatable for 16 credits.

OC 657. SEDIMENT BIOGEOCHEMISTRY. (3 Credits)

An overview of early diagenetic processes in marine sediments and the interdisciplinary approaches used to quantify material transformations at the seafloor.

Recommended: OC 550

OC 659. SPECIAL TOPICS IN CHEMICAL OCEANOGRAPHY. (1-4 Credits)

Special topics of current interest in chemical oceanography not covered in detail by other courses. May be repeated for credit when topic varies.

This course is repeatable for 16 credits.

OC 660. PALEOCEANOGRAPHY. (3 Credits)

Large-scale changes in the oceanic and atmospheric system, as recorded in marine sediments, and their implications for understanding global environment changes. Chemical, physical, and biological proxies for oceanic and atmospheric processes in the geologic record period. Evidence for changing global climate at time scales longer than the historical record; the oceanic history of the Late-Cenozoic ice ages, long term evolution of climate change patterns, catastrophic global environmental events, and application of quantitative models to the past. Current research topics in paleoceanography. Offered alternate years.

Recommended: OC 560

OC 662. NEARSHORE HYDRODYNAMICS. (3 Credits)

Briefly reviews wave processes in the nearshore, and concentrates on the wave-averaged circulation with an eye towards its potential effects on bathymetric change.

Recommended: Previous courses related to water wave mechanics and differential equations

OC 664. NEARSHORE SEDIMENT TRANSPORT. (3 Credits)

To study the dynamics of a nearshore wave field propagating over a shoaling bathymetry, the response of sediments and morphology to those motions, emergent morphology due to the coupled system, anthropogenic influences and mitigation.

Recommended: General physics, integral and differential calculus; nearshore hydrodynamics.

OC 666. ISOTOPIC MARINE GEOCHEMISTRY. (3 Credits)

Radiogenic and light stable isotopes and application to composition and evolution of the suboceanic mantle, petrogenesis of the oceanic crust, sediment provenance and sedimentary processes, geochronology, seawater chemical dynamics and paleoclimatology. Offered alternate years.

OC 668. THEORETICAL PETROLOGY. (3 Credits)

Theoretical aspects of igneous petrology in marine petrochemical processes. Igneous and metamorphic geology; hydrothermal solutions. Principles of energy, enthalpy, entropy. Equilibrium processes of melting, crystallization, mineral chemistry, geothermometers, geobarometers. Offered alternate years.

Recommended: Petrology.

OC 669. SPECIAL TOPICS IN GEOLOGICAL OCEANOGRAPHY. (1-4 Credits)

Subjects of current interest in geological oceanography not covered in depth in other courses. May be repeated for credit when topic varies.

This course is repeatable for 16 credits.

OC 670. FLUID DYNAMICS. (4 Credits)

Fundamentals of fluid dynamics: conservation laws of mass, momentum, and energy; inviscid and viscous flows; boundary layers; vorticity dynamics; irrotational and potential flow. Offered annually.

Recommended: One year of college physics; mathematics through differential equations and vector calculus.

OC 671. GEOPHYSICAL FLUID DYNAMICS. (4 Credits)

Dynamics of rotating and stratified fluids, potential vorticity, geostrophic motion; inviscid shallow-water theory, Poincare, Kelvin, and Rossby waves; geostrophic adjustment, quasigeostrophic approximation, Ekman layers, two-layer and continuously stratified models. Offered annually.

Prerequisites: OC 670 with C or better

OC 672. THEORY OF OCEAN CIRCULATION. (4 Credits)

Theory of steady and time-dependent large-scale circulation in ocean basins. Effects of earth's curvature: the beta-plane approximation. The wind-driven Sverdrup circulation, western boundary currents, eastern boundary upwelling; the effects of friction. Linear theory and nonlinear theory; inertial gyres. Effects of buoyancy forcing; heating, cooling, evaporation, precipitation; density stratification. Wind- and buoyancy-forced circulation in the thermocline; ventilation. Potential vorticity conservation and homogenization. Offered annually.

Prerequisites: OC 670 with C or better and OC 671 [C]

OC 673. DESCRIPTIVE PHYSICAL OCEANOGRAPHY. (4 Credits)

Fundamental mass, force, and energy balances of the ocean; geostrophy; planetary boundary layers; wind-driven and thermohaline circulation; vorticity; air-sea fluxes of heat, salt, moisture and momentum. Application of these balances through descriptive examination of the ocean-global heat budget; surface current systems; abyssal circulation. Study of variability on a variety of time and space scales. Instrumentation and platforms used for observing the ocean. Offered annually.

Prerequisites: OC 530 with C or better or OC 670 with C or better or ATS 515 with C or better

OC 674. TURBULENCE. (4 Credits)

Governing equations, turbulent kinetic energy, vorticity dynamics; turbulent transports of mass and momentum; statistical description of turbulent flows, spectral dynamics; turbulent boundary layers, planetary boundary layers in the atmosphere and ocean, convective mixed layers, stable boundary layers; deep ocean turbulence. Offered alternate years.

Prerequisites: OC 670 with C or better

OC 675. NUMERICAL MODELING IN OCEAN CIRCULATION. (4 Credits)

Review of theoretical models of ocean circulation, including shallow water, barotropic, quasigeostrophic, and primitive equation models; adjustment times, internal length and time scales; the role of advection, bathymetry, and coastlines; global models, basin models, regional models and models of jets, eddies and boundary currents. Review of numerical techniques and problems specific to ocean modeling. Local facilities are used to develop models on remote supercomputers.

Prerequisites: OC 670 with C or better

Recommended: Working knowledge of FORTRAN

OC 676. INVERSE MODELING AND DATA ASSIMILATION. (4 Credits)

Survey of methods for combining oceanographic observations and observing systems with numerical models of ocean circulation. Topics include: finite-dimensional least squares theory with inequality constraints; optimal interpolation; the representation theory of smoothing; the Kalman smoother and filter; gradient descent methods for minimization; spatial and temporal regularity of filters and smoothers; linear theory of array design; nonlinear optimization, practical assimilation methods.

Recommended: Strong background in linear algebra and advanced calculus, geophysical fluid dynamics, numerical modeling of ocean circulation.

OC 678. OCEAN REMOTE SENSING. (4 Credits)

Theory and applications of satellite remote sensing observations of the ocean with emphasis on strengths and limitations in the measurements. Topics include review of electricity and magnetism, absorption and scattering in the atmosphere (radiative transfer), satellite orbital mechanics, measurements of ocean color, infrared remote sensing, microwave radiometry, scatterometry, and satellite altimetry. Offered alternate years.

Recommended: MTH 252 and PH 212

OC 679. SPECIAL TOPICS IN PHYSICAL OCEANOGRAPHY. (1-4 Credits)

Subjects of current interest in physical oceanography, not covered in depth in other courses. May be repeated for credit when topic varies.

This course is repeatable for 16 credits.

OC 680. STABILITY OF GEOPHYSICAL FLUID FLOWS. (4 Credits)

Linear perturbation analysis applied to geophysical flows. These methods provide both quantitative and conceptual insight into the formative stages of turbulent flow. Emphasis is on practical numerical methods for the solution of differential eigenvalue problems. Examples are drawn from a wide range of geophysical flow instabilities, based in part upon student interests.

Prerequisites: OC 670 with C or better

Recommended: Multivariate calculus, matrix calculus, Matlab and concurrent enrollment in OC 670

OC 681. GEOPHYSICAL WAVES. (4 Credits)

Fundamentals of wave dynamics applied to geophysical fluids. Hyperbolic waves—linear and nonlinear; characteristics; shock waves. Dispersive waves—linear waves, dispersion relations, group velocity; isotropic and anisotropic dispersion; nonlinear solitary waves. Application to geophysical waves—surface gravity, capillary, internal gravity, Kelvin, planetary, coastal. Offered alternate years.

Prerequisites: OC 670 with C or better

OC 682. DATA ANALYSIS IN THE TIME AND SPACE DOMAINS. (4 Credits)

Theory of classical and modern techniques for analysis of data in the time and space domains with applications to real oceanographic and atmospheric data. Topics include correlation analysis, regression analysis, EOF analysis, objective mapping, interpolation, filtering, sampling errors, and confidence tests. Offered alternate years.

Recommended: MTH 341 and MTH 342 and MTH 418 and OC 608 and ST 314 and a working knowledge of Matlab, IDL, or FORTRAN

OC 683. DATA ANALYSIS IN THE FREQUENCY AND WAVE NUMBER DOMAINS. (4 Credits)

Theory of classical and modern techniques for analysis of data in the frequency and wavenumber domains with applications to real oceanographic and atmospheric data. Topics include sampling theory, one-dimensional autospectral analysis, multidimensional autospectral analysis, coherence and phase analysis, bi-spectral analysis, wavelet analysis, and confidence tests. Offered alternate years.

Recommended: MTH 341 and MTH 342 and MTH 418 and OC 608 and ST 314 and a working knowledge of Matlab, IDL, or FORTRAN

OC 691. PROPOSAL WRITING. (3 Credits)

Teaches the use of NSF Fastlane. Includes a discussion of ethics and fairness in reviewing, a review of real proposals by faculty, a simulated NSF funding panel, and then development of a real proposal, for review purposes. This will relate directly to the student's current thesis or project. The course enables graduate students from all disciplines to develop rigorous, well thought-out proposals. It should be taken early enough in the program so that the proposal process contributes to their research progress.

OC 808. WORKSHOP. (1-16 Credits)

This course is repeatable for 16 credits.