The course work requirements for Chemical Oceanography graduate students are outlined below. An individual student's program is the result of consultation with their faculty adviser and the Graduate Program Coordinator, to assure that course work not only meets School and option requirements, but also reflects the student's background and areas of interest within Chemical Oceanography. Waivers for School requirements should be referred to the Graduate Program Coordinator; waivers for Chemical Oceanography requirements may be granted by the faculty adviser.

### CHEMICAL OCEANOGRAPHY COURSES

Chemical Oceanography students are expected to complete the following course:

**OCEAN 520  MARINE CHEMISTRY (3)** Processes controlling the chemical composition of seawater. Chemical distributions in the ocean, marine physical chemistry, chemical equilibrium and concepts of mass balance. Mechanisms and models used to explain distributions of stable and radioactive isotopes, gases, trace metals, and biochemicals in the world's oceans.

Students are required to take three of the following seven courses for a Master's degree; six of the seven must be completed for a Ph.D.

**OCEAN 521  AQUATIC CHEMISTRY (3)** Application of physical chemistry and thermodynamics to processes that control chemical composition of natural waters. Equilibrium approach. Acid/base chemistry, the carbonate system, dissolution and precipitation, metal ions in solution, oxidation-reduction chemistry, silicate mineral reactions. Prerequisite: 520 or permission of instructor.

**OCEAN 522  MARINE ORGANIC GEOCHEMISTRY (3)** Sources, reactions, and fates of organic molecules in the marine environment. This course comprehensively covers the major molecular and isotopic constituents of natural organic materials in contemporary aquatic environments and processes which affect their distributions.

**OCEAN 529B  SEDIMENT BIOGEOCHEMISTRY**

**OCEAN 554  PALEOCLIMATE PROXIES (3)** Provides a critical evaluation of the most commonly applied paleoclimate proxies from the ocean, land, and ice sheets. Offered: jointly with ATM S 554/ESS 554.

**OCEAN 582  RIVER BASIN BIOGEOCHEMISTRY (3)** How rivers and river basins function in the transport of materials to the oceans and the importance of rivers in the biogeochemical cycles of elements, including origin of water and water routing with drainage basins, sources of dissolved and particulate materials in transport, within river modification of materials in transport, ecological theory, and reactions and transformations occurring in estuarine mixing zones. (Offered alternate years). Dr. Allan Devol, Dr. Jeffrey Richey.

**OCEAN 583  ISOTOPE BIOGEOCHEMISTRY (3)** The use of stable isotopes to study biogeochemical cycles in the oceans and atmosphere; specifically carbon, nitrogen, and sulfur cycles. Isotopic effects during photosynthesis, respiration, organic matter degradation, CaCO3 dissolution, methanogenesis, nitrification/denitrification, and sulfate reduction. (Offered alternate years).

**OCEAN 588  THE GLOBAL CARBON CYCLE AND CLIMATE (3)** Oceanic and terrestrial biogeochemical processes controlling atmospheric CO2 and other greenhouse gases. Records of past
changes in the earth's carbon cycle form geological, oceanographic and terrestrial archives. Anthropogenic perturbations to cycles. Develop simple box models, discuss results of complex models.

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SEMINARS

There is a weekly seminar in Chemical Oceanography. Students are required to attend and encouraged to present the results of their research after their first two years. In addition, courses on special topics of interest are offered as OCEAN 529, Seminar in Chemical Oceanography.

THE SCHOOL OUT-OF-OPTION REQUIREMENTS

Every graduate student is required to take a minimum of one 3-credit, numerically-graded, 500-level course from each option outside their own for a total of three courses and 9 credits. Each option will provide a list of courses that can be taken to fulfill this requirement. The student is expected to complete this breadth requirement prior to receiving an MS degree. A Graduate Student Affairs committee, chaired by the Graduate Program Coordinator, will address any requests for waivers.

Chemical Oceanography students are also encouraged to have a mathematical background through partial differential equations (equivalent to Applied Math 351/353 or 401/402) and a strong background in physical, inorganic or organic chemistry.