**Description**

The Oceanography (OCE) graduate program has a diverse set of faculty, staff, and students who examine ocean processes in broad fields of physical, biological, chemical, and geological oceanography and geophysics. Basic and applied research of an experimental, numerical, and analytical nature is conducted in oceanic settings that range from shallow nearshore and estuarine waters to the deep ocean and span all ocean basins on earth including the Arctic.

OCE offers programs leading to M.Sc. and Ph.D. degrees. These interdisciplinary programs prepare students for professional careers in ocean-related fields. In addition, students can also pursue an ocean mapping option within the Department of Earth Sciences and carried out within the Center for Coastal and Ocean Mapping.

**Research and Facilities**

The oceanography graduate program within the Department of Earth Sciences and the School of Marine Science and Ocean Engineering (SMSOE) is enhanced by the ocean engineering and marine biology graduate programs, and by other departments and institutes at UNH, including the civil and mechanical engineering and biology departments; the Institute for the Study of Earth, Oceans, and Space (EOS); the Center for Coastal and Ocean Mapping (CCOM); and the Ocean Processes Laboratory (OPAL). Other related programs include the N.H. Sea Grant Program, the Center for Collaborative Science, and the Atlantic Marine Aquaculture Center, Coastal Response Research Center (CRRC), Northeast Consortium (NEC), and the Piscataqua Region Estuaries Partnership (PREP). Oceanographic laboratories at UNH include the Shoals Marine Laboratory (SML) on Appledore Island, the Coastal Marine Laboratory (CML) in Newcastle, the Jackson Estuarine Laboratory (JEL) at Adams Point on the Great Bay, and the Chase Ocean Engineering Laboratory (COEL) on the main UNH campus. Additional laboratories for the oceanography faculty are located on campus in James, Morse, Rudman, and Spaulding Halls. The SMSOE operates a marine support facility and two UNH research vessels moored in Portsmouth Harbor at the UNH pier, the R/V Gulf Challenger and the R/V Gulf Surveyor, as well as a number of small boats. The SMSOE also supports the UNH Diving Program and oversees a shared use Instrumentation Pool for student and faculty use.

**Admission Requirements**

Applicants should have completed an undergraduate major related to one of the oceanography disciplines, including biology, chemistry, engineering, geology, physics, or mathematics, or an appropriate array of science and engineering courses within their major field. Applicants are expected to have completed one year each of calculus and chemistry and two semesters of physics and/or biology. It is not necessary to have had previous coursework in oceanography.

**Requirements**

**M.S. Degree Requirements**

**Students must complete a minimum of 30 credits for the thesis option or 34 credits for the non-thesis option.**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ESCI 997</td>
<td>Seminar in Earth Sciences</td>
<td>1</td>
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<tr>
<td>ESCI 998</td>
<td>Proposal Development</td>
<td>1</td>
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Select two of the following core courses:

- BIOL 855 Biological Oceanography
- ESCI 852 Chemical Oceanography
- ESCI 858 Introduction to Physical Oceanography
- ESCI 859 Geological Oceanography

Select one of the following:

- OCE 899 Master's Thesis (acceptable to the thesis-examining committee and must pass a thesis defense)
- ESCI #898 Directed Research
  or OCE #898 Directed Research

**Other Relevant Graduate Courses**

- CEE 822 Introduction to Marine Pollution and Control
- ESCI 801 Quantitative Methods in Earth Sciences
- ESCI 820 Ocean Measurements Lab
- ESCI 834 Geophysics
- ESCI 841 Geochemistry
- ESCI 845 Isotope Geochemistry
- ESCI 847 Aqueous Geochemistry
- ESCI 854 Sedimentology
- ESCI 856 Geoecotones
- ESCI 860 Paleooceanography
- ESCI 862 Glacial Geology
- ESCI 864 Spectral Analysis of Geophysical Time Series Data
- ESCI 865 Paleoclimatology
- ESCI 871 Geodesy and Positioning for Ocean Mapping
- ESCI 874 Integrated Seabed Mapping Systems
- ESCI 875 Advanced Topics in Ocean Mapping
- ESCI 896 Topics (nearshore Processes)
- ESCI 972 Hydrographic Field Course
- ESCI 995 Advanced Topics (Geophysical Fluid Dynamics)
- ESCI 996 Advanced Topics (Ocean Modeling)
- IAM 940 Asymptotic and Perturbation Methods
- MATH 835 Statistical Methods for Research
- MATH 839 Applied Regression Analysis
- MATH 845 Foundations of Applied Mathematics I
- MATH 846 Foundations of Applied Mathematics II
- MATH 853 Introduction to Numerical Methods
- ME 807 Analytical Fluid Dynamics
- ME 910 Turbulence
- ME 812 Waves in Flows
- MEFB 825 Marine Ecology
- NR 844 Biogeochemistry (or ESCI 896 Topics (Biogeochemistry))
- OE 853 Ocean Hydrodynamics
- OE 854 Ocean Waves and Tides
- OE 857 Coastal Engineering and Processes
- OE 865 Underwater Acoustics
- OE 995 Graduate Special Topics (Coastal Sediment Transport)
- ZOOL 810 Sharks and Bony Fishes
- ZOOL 872

Total Credits 30-34

**Student Learning Outcomes**

Students graduating with a MS in Oceanography should be able to:

Core Knowledge

1. Demonstrate knowledge of the oceanography disciplines, including biology, chemistry, engineering, geology, physics, or mathematics.
2. Apply basic principles of physical, biological, chemical, and geological oceanography and geophysics to solve problems in ocean science.
3. Conduct research in an area of oceanography.
4. Communicate research findings effectively in both oral and written forms.
5. Apply analytical and numerical methods to oceanic problems.
6. Interpret and analyze oceanographic data using appropriate statistical methods.
7. Design and execute oceanographic field experiments.
8. Understand the role of oceanography in addressing global environmental issues.
9. Demonstrate an understanding of the ethical implications of oceanographic research.
• Demonstrate a foundation of knowledge in at least 2 of the main branches of oceanography: Geological, Biological, Physical, or Chemical.

• Geological Oceanography: An understanding marine geology and geophysics, including the structure of the Earth, Plate Tectonic Theory, marine sedimentology, paleoceanography, and the global carbon cycle.

• Biological Oceanography: An understanding of marine ecosystems, including the physical and chemical processes that govern nutrient and light availability, the concept of food webs, and fisheries and anthropogenic interactions with fish stocks.

• Physical Oceanography: An understanding of the physics of the ocean, including how wind and thermal forcing at the surface interact with the Earth’s rotation to drive ocean circulation in the deep basins and shallow continental shelves and oceanic plateaus, tides, and surface gravity waves.

• Chemical Oceanography: An understanding of the chemistry and chemical interactions in seawater, including biogeochemical processes that govern the distribution and cycling of elements and nutrients, processes that add and remove elements in the ocean, isotopic fractionation, and how ocean chemistry interacts with seafloor sediments and the ocean crust.

• Demonstrate basic knowledge of how the processes within the main branches of oceanography interact with each other.

• Demonstrate specialized knowledge of a field within oceanography sufficient to conduct substantive supervised research.

Research Methods and Analysis

• Identify and demonstrate knowledge of a range of qualitative and quantitative methodologies typically used in oceanographic research and critically read research that uses these methods.

• Discover and critically read published research in oceanographic and related fields of the Earth Sciences, Mathematics, Statistics, Physics, Chemistry, and Biology.

• Frame empirical research and/or theory guided by prior knowledge.

• Implement a rigorous study using appropriate methods, measures and techniques.

• Critically evaluate and systematically analyze data to reach appropriate findings and interpretations.

Research Independence

• Develop and implement directed research projects that meets high standards of theoretical and methodological rigor.

Scholarly Communication

• Structure a coherent argument that rigorously presents and evaluates evidence to support claims.

• Review and cogently synthesize relevant literature.

• Write at a level and in a style of English consistent with that found in leading academic journals.

• Understand and properly use styles of citing, referencing, and formatting found in leading academic journals.

• Clearly convey research findings through oral presentation supported by appropriate digital media.

• Cogently summarize research and its significance to non-specialist audiences.

Professionalism and Pedagogy

• Prepare manuscripts that meet the standards of academic and research journals and respond appropriately to recommendations for revision.

• When demanded, demonstrate collaboration, leadership and teamwork through participation in research teams and lab groups.

• Make effective contributions to university, community and professional service.

• Communicate effectively to groups in a lecture format.