OCEAN ENGINEERING (OE)

Degrees Offered: Ph.D., M.S., Graduate Certificate

This program is offered in Durham.

Ocean engineering (OE) offers programs leading to the master of science and doctor of philosophy degree in ocean engineering. Programs in OE are by definition interdisciplinary and require students to interact with the ocean science community, as well as the traditional engineering disciplines. Students are exposed to the broad–based issues of working engineering problems in the ocean environment, as well as discipline specifics. In these programs they will be trained to develop responsible solutions to problems that will lead to sustainable activity and life in the ocean.

A master of science in ocean engineering with an option in ocean mapping is available. This is a more structured path through the program, which is approved by the International Hydrographic Organization (IHO) and incorporates all aspects of hydrography as required by the IHO. Focus is on the engineering aspects of hydrography. The general purpose of these programs is to prepare engineering students for professional careers in ocean-related fields.

Additionally, graduate certificates in ocean mapping and acoustics are offered.

Admission Requirements

Applicants should have completed a baccalaureate degree in either chemical, civil, electrical, or mechanical engineering, or have an equivalent background.

https://ceps.unh.edu/ocean-engineering/academics

Programs

- Ocean Engineering (Ph.D.)
- Ocean Engineering (M.Eng.)
- Ocean Engineering (M.S.)
- Ocean Engineering: Ocean Mapping (M.S.)
- Acoustics (Graduate Certificate)
- Ocean Mapping (Graduate Certificate)

Courses

Ocean Engineering (OE)

OE 817 - Marine Robotics and Applications
Credits: 3
This course covers (lecture/lab format) the broad spectrum of marine vehicles and applications, as well as what is involved in designing and building robotic vehicles for specific missions. Course topics include: marine applications, sensors for marine environments, vehicle subsystems, ocean and open water environment, dynamic modeling and control, and design/fabrication/testing. Various invited speakers (both scientists and engineers) provide learning modules on various marine robotic related topics. Graduate students will be assigned extra project work.
Equivalent(s): ME 817
Grade Mode: Letter Grading

OE 820 - Design of Recirculating Aquaculture Systems
Credits: 3
The purpose of this course is to provide a practical engineering approach to the design of land-based, recirculating aquaculture systems. The course includes an introductory background on the state of our global seafood industries and the need for sustainable production approaches in fresh, brackish, and saltwater environments with various types of systems presently in use. With a focus on recirculating aquaculture systems, this course will include topics such as environmental chemistry and water quality, stoichiometric analyses, nitrification, the potential of hydrogen, temperature, dissolved oxygen, carbon dioxide, the carbonate cycle and alkalinity. A systems design approach will then be covered to include developing plans for assessing biomass growth, system oxygen consumption and total nitrogen and carbon dioxide production. System design will consider processes associated with tank hydrodynamics, waste settling, solids removal, biofiltration, UV treatment, temperature control, aeration, degassing, pumps, and piping systems. Mass balance approaches through control volumes will be examined. A hands-on, student led system design project will be required and examined using engineering economic principles such as the time value of money, inflation, taxes, and internal rates of return. The use of computer tools will be necessary. To distinguish OE 820 from the OE 720 level students, homework assignments, exams, and course projects will include additional in-depth components. Graduate students in the class will also be expected to have a suitable background in mathematics, physics, and chemistry commensurate with the UNH courses MATH 426, PHYS 408, and CHEM 405.
Grade Mode: Letter Grading

OE 853 - Ocean Hydrodynamics
Credits: 3
Fundamental concepts of fluid mechanics as applied to the ocean; continuity; Euler and Navier-Stokes equations; Bernoulli equation; stream function, potential function; momentum theorem; turbulence and boundary layers are developed with ocean applications.
Prerequisite(s): MATH 527 with a minimum grade of D- and (CEE 650 with a minimum grade of D- or ME 608 with a minimum grade of D-).
Grade Mode: Letter Grading

OE 854 - Ocean Waves and Tides
Credits: 4
Small amplitude, linear wave theory, standing and propagating waves, wave energy, refraction, diffraction, transformation in shallow water, statistics of random seas, spectral energy density, generating eave time series using the random phase methods forces on structures, Froude scaling of wave tank experiments, nonlinear effects. Description of tides as long waves, equilibrium tide, mathematical modeling including friction, nonlinear effects, and Coriolis forces, tidal analysis, the Great Bay Estuarine System as a case study. Requires knowledge of calculus-based physics and differential equations.
Equivalent(s): EOS 854
Grade Mode: Letter Grading

OE 857 - Coastal Engineering and Processes
Credits: 3
Introduction to small-amplitude and finite-amplitude wave theories. Wave forecasting by significant wave method and wave spectrum method. Coastal processes and shoreline protection. Wave forces and wave structure interaction. Introduction to mathematical and physical modeling. Requires knowledge of fluid dynamics.
Grade Mode: Letter Grading

OE 858 - Design of Ocean Structures
Credits: 3
The foundational information necessary for the design of ocean structures. Topics include floating body, fixed body and moored line hydrostatics; wave forces on small and large bodies; dynamic response of floating bodies; and pile and gravity foundation geotechnics. Requires knowledge of mechanics of materials, fluid mechanics, differential equations, and ocean waves and tides.
Grade Mode: Letter Grading

OE 865 - Underwater Acoustics
Credits: 3
An introduction to acoustics in the ocean. Fundamental acoustic concepts including the simple harmonic oscillator, waves on strings, and the acoustic wave equation; the sonar equation; sound generation and reception by underwater acoustic transducers and arrays; basics of sound propagation; reflection and scattering from ocean boundaries. Spring semester; offered every year; satisfies core course requirement in Ocean Engineering. Requires knowledge of differential equations and college physics.
Grade Mode: Letter Grading

OE 870 - Geodesy for Ocean Mapping
Credits: 3
Ocean mapping requires precise positioning and navigation. For this we need to precisely know Earth's shape, gravity field, and orientation in space. Data used for this purpose include satellite-based positioning, gravity measurements, and ground surveys. Reference frames can then be created allowing the integration of geometric observations for the creation of mapping products. One year of calculus and one year of college physics prior to taking this course.
Grade Mode: Letter Grading

OE 871 - Positioning for Ocean Mapping
Credits: 4
Ocean mapping requires precise positioning and navigation. For this we need to precisely know Earth's shape, gravity field, and orientation in space. Data used for this purpose include satellite-based positioning, gravity measurements, and ground surveys. Reference frames can then be created allowing the integration of geometric observations for the creation of mapping products. This course will focus on this integration of measurements and the uncertainty associated to them.
Prerequisite(s): OE 770 with a minimum grade of D- or OE 870 with a minimum grade of B- or ESCI 870 with a minimum grade of B-.
Equivalent(s): ESCI 871
Grade Mode: Letter Grading

OE 874 - Integrated Seabed Mapping Systems
Credits: 4
Overview of typical applications that involve mapping the sediment-water interface in the ocean and adjacent waters. Emphasis on defining the task-specific resolution and accuracy requirements. Fundamentals of acoustics relevant to seabed mapping. Progressions through typical configurations involving single beam, sidescan, phase differing and multibeam systems. Integration of asynchronous 3D position, orientation and sound speed measurements with sonar-relative acoustic travel times and angles. Analysis of impact offsets, mis-alignments and latency in all integrated sensors.
Equivalent(s): ESCI 874
Grade Mode: Letter Grading

OE 875 - Advanced Topics in Ocean Mapping
Credits: 4
The second of two courses covering the principles and practices of hydrography and ocean mapping. In this course the following topics are covered: Verification and Field QA/QC, Water Levels (Tides); Mapping Standards; Survey Planning, Execution and Reporting; Terrain Analysis; Optical Remote Sensing; Data Presentation; Seafloor Characterization; Electronic Navigational Charts; Hydrography for Nautical Charting, Product Liability and contracts; and the United Nations Convention for the Law of the Sea (UNCLOS).
Prerequisite(s): OE 874 with a minimum grade of B- or ESCI 874 with a minimum grade of B- or OE 870 with a minimum grade of B- or ESCI 870 with a minimum grade of B- or ESCI 872 with a minimum grade of B-.
Equivalent(s): ESCI 875
Grade Mode: Letter Grading

OE 899 - Master's Thesis
Credits: 1-6
Master's Thesis.
Repeat Rule: May be repeated for a maximum of 6 credits.
Grade Mode: Graduate Credit/Fail grading

OE 965 - Advanced Underwater Acoustics
Credits: 3
Focused topics varying from year to year depending on student interests and need. Topics may include one or more of the following: sonar systems engineering; underwater acoustic transducers; volume and surface scattering; underwater acoustic propagation; fisheries acoustics. Spring semester; offered every other year.
Prerequisite(s): OE 765 with a minimum grade of D- or OE 865 with a minimum grade of B-.
Repeat Rule: May be repeated for a maximum of 9 credits. May be repeated up to 2 times.
Grade Mode: Letter Grading

OE 972 - Hydrographic Field Course
Credits: 4
A lecture, lab, and field course on the methods and procedures for the acquisition and processing of hydrographic and ocean mapping data. Practical experience in planning and conducting hydrographic surveys. Includes significant time underway (day trips and possible multi-day cruises) aboard survey vessel(s).
Prerequisite(s): OE 875 with a minimum grade of B- and OE 871 with a minimum grade of B-.
Equivalent(s): ESCI 972
Grade Mode: Letter Grading

OE 990 - Ocean Seminars I
Credits: 1
Various topics, including marine systems design, marine vehicle operation, data collecting and processing, and marine law.
Grade Mode: Graduate Credit/Fail grading

OE 991 - Ocean Seminars II
Credits: 1
Various topics, including marine systems design, marine vehicle operation, data collecting and processing, and marine law.
Grade Mode: Graduate Credit/Fail grading

OE 995 - Graduate Special Topics
Credits: 1-4
Investigation of graduate-level problems or topics in ocean engineering.
Repeat Rule: May be repeated for a maximum of 16 credits.
Grade Mode: Letter Grading

OE 998 - Independent Study
Credits: 1-4
Independent theoretical and/or experimental investigation of an ocean engineering problem under the guidance of a faculty member.
Grade Mode: Letter Grading

OE 999 - Doctoral Research
Credits: 0
Doctoral Research.
Grade Mode: Graduate Credit/Fail grading
Special Fee: Yes

Faculty

Ocean Engineering Department Faculty