OCEAN ENGINEERING

Mission

The undergraduate program in ocean engineering emphasizes ocean engineering fundamentals while offering interdisciplinary opportunities for focused study in civil, electrical, environmental, or mechanical engineering, as well as marine sciences.

Program Educational Objectives

The ocean engineering program seeks to provide an environment that enables students to pursue their goals in an innovative, rigorous, and challenging program with a diversity of offerings. The program has the following major educational objectives, with the expectation that alumni will have successful careers in the many diverse areas of the ocean engineering profession. Within a few years of obtaining a bachelor's degree in ocean engineering, we expect our graduates to have the following attributes:

Depth. To be effective in applying ocean engineering principles in engineering practice or for advanced study in ocean engineering.

Breadth. To have a productive career in the many diverse fields of ocean engineering such as coastal engineering, ocean acoustics, offshore structures, and marine renewable energy, or in the pursuit of graduate education in disciplines that include marine science, engineering, medicine, law, or business.

Professionalism. To function effectively in the complex modern work environment with the ability to assume professional leadership roles.

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

Programs

- Ocean Engineering Major (B.S.)
- Ocean Engineering Minor

Courses

Ocean Engineering (OE)

OE 400 - Ocean Engineering Seminar
Credits: 1
A seminar based course considering contemporary topics involved in ocean exploration. Faculty and guest speakers will describe thematic ocean engineering subareas through weekly presentations. The presentations will provide examples of engineering applications and ocean exploration. Class participation credit can be earned through oral discussions, presentation of contemporary OE topics, or hands on projects.
Repeat Rule: May be repeated for a maximum of 2 credits.
Grade Mode: Credit/Fail Grading

OE 401 - Ocean Engineering Seminar
Credits: 1
A seminar based course considering contemporary topics involved in ocean exploration. Faculty and guest speakers will describe thematic ocean engineering subareas through weekly presentations. The presentations will provide examples of engineering applications and ocean exploration. Class participation credit can be earned through oral discussions, presentation of contemporary OE topics, or hands on projects.
Repeat Rule: May be repeated for a maximum of 2 credits.
Grade Mode: Credit/Fail Grading

OE 490 - Introduction to Ocean Engineering
Credits: 4
Survey of engineering applications in the ocean environment. Topics vary an include hydrodynamics, waves, tides, underwater sound, instrumentation, marine geomechanics, and naval architecture. Includes guest lectures by faculty members from the Engineering departments.
Co-requisite: PHYS 407
Grade Mode: Letter Grading

OE 610 - Ocean Instrumentation Lab
Credits: 4
An investigation of the discrete and integrated electronics typically used in the design and implementation of ocean instruments. Topics include both passive and active analog electronic elements typically used for signal conditioning of common oceanographic sensors (e.g., thermistors, pressure sensors, acoustic transducers); A/D and D/A conversion, sensor sampling criteria and rules, with examples from contemporary ocean instruments; embedded micro-controller/microcomputer modules for autonomous or remote sensing in ocean environments; inter-instrument communications methods typically used in ocean instruments (e.g., serial and network communications). Laboratory time will be used to develop practical experience in specification, design, development and testing of various ocean instrument components based on the material presented.
Prerequisite(s): MATH 527 with a minimum grade of D- and MATH 528 with a minimum grade of D- and ECE 537 with a minimum grade of D- and IAM 550 with a minimum grade of D-.
Grade Mode: Letter Grading

OE 677 - Seamanship and Marine Weather for Ocean Engineers and Scientists
Credits: 2
A survey of basic principles of seamanship and marine weather intended for ocean engineers and ocean scientists. Reviews ship and vessel nomenclature, shipboard safety, techniques for equipment handling and instrument deployment, common shipboard evolutions associated with scientific cruises, navigation principles, and marine weather phenomena and products. Includes field trips and practical applications.
Grade Mode: Credit/Fail Grading

OE 717 - Marine Robotics and Applications
Credits: 3
The purpose of this course is to cover (in lecture and 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.
Co-requisite: ME 670
Equivalent(s): ME 717
Grade Mode: Letter Grading

OE 720 - 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. Use of computer tools will be necessary.
Prerequisite(s): (MATH 426 with a minimum grade of D- or MATH 424B with a minimum grade of D-) and (PHYS 407 with a minimum grade of D- or PHYS 407S with a minimum grade of D- or PHYS 407H with a minimum grade of D- or (PHYS 401 with a minimum grade of D- and PHYS 402 with a minimum grade of D-)) and (CHEM 405 with a minimum grade of D- or (CHEM 403 with a minimum grade of D- and CHEM 404 with a minimum grade of D-)).
Grade Mode: Letter Grading

OE 753 - 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, moment 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 754 - 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.
Prerequisite(s): (PHYS 407 with a minimum grade of D- or PHYS 407S with a minimum grade of D- or PHYS 407H with a minimum grade of D-) and MATH 527 with a minimum grade of D- and MATH 528 with a minimum grade of D-.
Grade Mode: Letter Grading

OE 757 - Coastal Engineering and Processes
Credits: 3
Introduces 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.
Prerequisite(s): CEE 650 with a minimum grade of D- or ME 608 with a minimum grade of D-.
Grade Mode: Letter Grading

OE 758 - Design of Ocean Structures
Credits: 3
The foundational information necessary for the design of ocean structures. Topics include analysis and design of 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.
Prerequisite(s): (ME 526 with a minimum grade of D- or CEE 502 with a minimum grade of D-) and (ME 608 with a minimum grade of D- or CEE 650 with a minimum grade of D-) and OE 754 with a minimum grade of D- and MATH 527 with a minimum grade of D-.
Grade Mode: Letter Grading

OE 765 - 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.
Prerequisite(s): (PHYS 408 with a minimum grade of D- or PHYS 408S with a minimum grade of D- or PHYS 408H with a minimum grade of D-) and MATH 527 with a minimum grade of D-.
Grade Mode: Letter Grading

OE 770 - 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.
Prerequisite(s): (MATH 426 with a minimum grade of D- or MATH 426H with a minimum grade of D-) and (PHYS 407 with a minimum grade of D- or PHYS 407S with a minimum grade of D- or PHYS 407H with a minimum grade of D- or PHYS 401 with a minimum grade of D-).
Grade Mode: Letter Grading

OE 771 - Positioning for Ocean Mapping
Credits: 4
Ocean mapping necessitates accurate positioning and navigation, which, in turn, rely on a comprehensive grasp of measurement methodologies. This course will comprehensively examine various positioning techniques, including spirit leveling, total stations, Global Navigation Satellite Systems (GNSS), inertial navigation systems (INS), and underwater acoustic positioning systems. Emphasis will be placed on the observational methodologies associated with each technology, along with the propagation of observation uncertainty.
Prerequisite(s): (MATH 426 with a minimum grade of D- or MATH 426H with a minimum grade of D-) and (PHYS 407 with a minimum grade of D- or PHYS 407S with a minimum grade of D- or PHYS 407H with a minimum grade of D- or PHYS 401 with a minimum grade of D-).
Equivalent(s): ESCI 771
Grade Mode: Letter Grading

OE 774 - 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. Progression 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 time and angles. Analysis of impact of offsets, mis-alignments and latency in all integrated sensors.
Grade Mode: Letter Grading

OE 795 - Special Topics
Credits: 2-4
New or specialized courses and/or independent study. May be repeated barring duplication of subject.
Repeat Rule: May be repeated up to unlimited times.
Grade Mode: Letter Grading

OE 796 - Independent Study
Credits: 1-4
Independent study for exceptional students. Individual reading, writing, or laboratory work carried out under the tutelage of a faculty member. May be used as a technical elective for the ocean engineering major if taken for 3-4 credits.
Repeat Rule: May be repeated for a maximum of 4 credits.
Grade Mode: Letter Grading

OE 797 - Honors Seminar
Credits: 1
Course enrichment and/or additional independent study in subject matter pertaining to 600- or 700-level OE courses.
Attributes: Honors course
Repeat Rule: May be repeated for a maximum of 3 credits. May be repeated up to 3 times.
Grade Mode: Letter Grading

Faculty

Ocean Engineering Department Faculty