

OCEAN ENGINEERING (OE)

Mission

The mechanical engineering department strives to prepare students for productive careers in industry or government as well as to provide a foundation for graduate studies. 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://marine.unh.edu/oe>

Programs

- Ocean Engineering Major (B.S.) (<http://catalog.unh.edu/undergraduate/engineering-physical-sciences/programs-study/ocean-engineering/ocean-engineering-major-bs>)
- Ocean Engineering Minor (<http://catalog.unh.edu/undergraduate/engineering-physical-sciences/programs-study/ocean-engineering/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.

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.

OE 521 - Power of the Sea: Scientific Discovery in the Ocean

Credits: 4

This course considers the struggle to understand the physics of the sea to help predict when the sea will unleash its fury. The scientific discovery of ocean engineering topics such as tides, waves, and tsunamis are introduced through their human historical introduction. The historical significance and preliminary resolution of each physical mechanism provide context for the fundamental formulations and contemporary predictive models. The course also considers the role of ocean disasters and geopolitical conflict in motivating scientific exploration of the oceans.

Attributes: Physical Science(Discovery)

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. Prereq: MATH 527; MATH 528; ECE 537 ; IAM 550.

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.

OE 690 - Introduction to Ocean Engineering

Credits: 4

Survey of engineering applications in the ocean environment. Topics vary and include hydrodynamics, waves, tides, underwater sound, instrumentation, marine geomechanics, and naval architecture. Includes guest lectures by faculty members from the Engineering departments. Prereq: PHYS 408 Pre- or Coreq: MATH 527.

OE 710 - Ocean Measurements Lab

Credits: 4

Measurements of fundamental ocean processes and parameters. Emphasizes understanding typical offshore measurements, their applications, and the use of acquired data, in terms of the effects on structures and processes in the ocean.

OE 744 - Corrosion**Credits: 4**

Three-part course. First part reviews and develops basic concepts of electrochemistry, kinetics, and measurement methods. Second part covers details of specific corrosion mechanisms and phenomena including passivity, galvanic corrosion, concentration cell corrosion, pitting and crevice corrosion, and environmentally induced cracking. Third part focuses on the effects of metallurgical structure on corrosion, corrosion in selected environments, corrosion prevention methods, and materials selection and design. Prereq: CHEM 404 or 405; ME 561 or permission. Special fee. Lab. (Also listed as CHE 744 and ME 744.)

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. Prereq: MATH 527; CIE 642 or ME 608.

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 wave 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. Prereq: PHYS 407; MATH 527, and MATH 528.

OE #756 - Principles of Naval Architecture and Model Testing**Credits: 4**

Fundamentals of naval architecture presented, including hydrostatics, basics of resistance and propulsion, sea keeping and scaling. Concepts applied in experiments utilizing the tow/wave tank and associated instrumentation. Prereq: ME 608 or equivalent; ME 627 or equivalent.

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. (Also offered as CIE 757; ME 757.) Prereq: fluid dynamics or permission.

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. Prereq: ME 526; ME 608; ME 627, OE 754; MATH 527; or permission.

OE 759 - Estuarine and Coastal Modeling**Credits: 4**

Theory and application of coastal and estuarine numerical models for hydrodynamics and transport/fate of natural and pollutant substances. The course will be organized around the development/addition to a numerical model applied to the Great Bay Estuarine System. Theory and course organization will be covered in the lecture component. The full set of steps required to apply, test, use and document a numerical model will be completed in the laboratory component. Prereq: MATH 527; MATH 528, OE 754 or permission.

OE 764 - Spectral Analysis of Geophysical Time Series Data**Credits: 4**

This course considers basic exploratory techniques and in-depth spectral analysis for estimation with geophysical time series data, including calculations of confidence intervals and significance testing. This course prepares students for interpreting time series data with science and engineering applications. Topics include sampling theory, filtering, statistics, probability, spectral analysis, and empirical orthogonal functions. Students gain experience in code-writing for the analysis of time series data. Prereq: MATH 426.

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. Prereq: PHYS 407/408, MATH 527 or equivalent.

OE 771 - Geodesy and Positioning for Ocean Mapping**Credits: 4**

The science and technology of acquiring, managing, and displaying geographically-referenced information; the size and shape of the earth, datums and projections; determination of precise positioning of points on the earth and the sea, including classical terrestrial-based methods and satellite-based methods; shoreline mapping, nautical charting and electronic charts. Prereq: MATH 426, PHYS 408. (Also listed as ESCI 771.)

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.

OE 795 - Special Topics**Credits: 2-4**

New or specialized courses and/or independent study. May be repeated for credit.

OE 797 - Honors Seminar**Credits: 1**

Course enrichment and/or additional independent study in subject matter pertaining to 600- or 700-level OE courses.

Faculty

<https://ceps.unh.edu/directory/all>