

Ocean Engineering

Undergraduate Courses

Introduction to Logic Design (CDA 3201C) 4 credits
Introduction to Programming in C (COP 2220) 3 credits
 (See Computer Science and Engineering Dept. courses, this section)

Circuits I (EEL 3111) 3 credits
Electronics I (EEL 3300) 4 credits
Digital Electronics for Non-EE Majors (EEL 3341C) 3 credits
 (See Electrical Engineering Dept. courses, this section)

Engineering Graphics (EGS 1111C) 3 credits
 (See Mechanical Engineering Dept. courses, this section)

Honors Seminar (EOC 1930) 3 credits
Gordon Rule, writing (6,000 words)

Prerequisite: Permission of instructor

Special topics course for freshmen and sophomores in which the approach is generally philosophical and/or historical and which focuses on basic questions and issues of enduring importance related to the topic. The course emphasizes improvement of students' critical thinking and writing skills.

Ocean Engineering Diving (EOC 2131C) 1 credit
 (Not a required course)

Prerequisite: Nationally recognized dive certification and permission of instructor.

This course averages one lecture and one four-hour dive trip per week. Lectures cover scientific diving techniques. Field work provides students with hands-on experience in conducting underwater scientific experiments.

Fabrication of Ocean Engineering Systems (EOC 2801) 1 credit

A laboratory course directed to acquainting ocean engineering students with the basic machinery and machining processes used to fabricate parts of engineering systems for use in an ocean environment.

Professional Development for Ocean Engineers (EOC 2902) 1 credit
 (Not a required course)

Prerequisite: ENC 1101

A study of professionalism as it relates to ocean engineering with the following topics: written and oral business communications and processes, company organization and operations, management of resources, and professional ethics.
Grading: S/U

Statics (EOC 3105) 3 credits

Prerequisites: MAC 2253, PHY 2043, PHY 2048L, Corequisite: EGS 1111C

Analysis of force and moment systems for static equilibrium of trusses, frames, beams, cables and machines; friction forces and friction machines; first and second area and mass moments and centers of gravity; potential energy and virtual work. A grade of "C" or better is required for the major.

Dynamics (EOC 3113) 3 credits

Prerequisite: EOC 3105

Dynamic analysis of particles, kinematics, kinetics and relative motion. Kinematics of rigid bodies, plane motion and general motion. A grade of "C" or better is required for the major.

Vibrations (EOC 3114) 3 credits

Prerequisites: EOC 3113, MAP 4306, and EOC 3150

Free and forced vibrations of single- and multi-degree-of-freedom systems, harmonic, periodic, and shock excitation, impedance concepts, motion sensors, vibration criteria, and simple continuous systems, simple buoys and ocean applications. A grade of "C" or better is required for the major.

Fluid Mechanics I (EOC 3123) 4 credits

Prerequisites: EOC 3113, EOC 3141, COP 2220, MAP 4306, EOC 3130L

The first course of a two-semester study of incompressible-fluid flow and its application to ocean engineering with emphasis on fluid properties, hydrostatic forces, buoyancy and stability of floating bodies including metacentric height concepts, fluid dynamics, dimensional analysis, modeling, real flows in closed conduits and open channels, boundary-layers, lift and drag, turbo-machines, computational and experimental methods, resistance and propulsion of marine vehicles, and design problems. A grade of "C" or better is required for the major.

Ocean Engineering Laboratory (EOC 3130L) 3 credits

Prerequisites: CHM 2045, 2045L; PHY 2044, 2049L; MAP 2302, COP 2220

Introduction to engineering laboratory methods and techniques with experiences in measurements, experiment planning, data recording, and laboratory report preparation. Five major lab experiences, including one or more at sea, are included.

Engineering Thermodynamics (EOC 3141) 3 credits

Prerequisites: MAC 2313, CHM 2045, CHM 2045L, PHY 2044

Definitions, properties, state of pure substance, macroscopic thermodynamic processes, systems and cycles, work and heat, first and second laws, entropy, availability, irreversibility, efficiency. Applications of concepts to ideal gases, gas and vapor mixtures, vapor and gas cycles. Problems for ocean engineering are stressed. Note: A grade of "C" or better is required for the major.

Strength of Materials (EOC 3150) 3 credits

Prerequisites: EOC 3105

Mechanical properties of engineering materials; analysis of stress and strain, shear, bending moment and torsional moment; deformation of elastic material; stability of column and thin shell. A grade of "C" or better is required for the major.

Engineering Materials I (EOC 3200) 3 credits

Prerequisite: EOC 3141; Corequisite: EOC 3150

Structure of material systems from the atomic, micro and macroscopic standpoints. Equilibrium and nonequilibrium structures. Relationship between structure and electrical, thermal, mechanical and failure properties of materials. Phase diagrams and reaction rate theory for materials. Strengthening mechanisms in materials.

Acoustics I (EOC 3306) 3 credits

Prerequisites: EEL 3111, EOC 3130L, MAP 4306

Fundamentals of acoustics. Sound propagation in fluids; speech, hearing, noise, architectural acoustics, loudspeakers, microphones, transducers, underwater sound transmission.

Structural Analysis I (EOC 3410C) 3 credits

Prerequisite: EOC 3150

Classical methods of analysis of beams, trusses, frames, cables, and arches for ocean and other structural applications. Approximate methods, moment area, virtual work, consistent deformations.

Ocean and Environmental

Data Analysis (EOC 3631C) 3 credits

Prerequisites: EOC 3130L, MAP 4306

Fourier transform applications to the processing of ocean engineering related types of signals. Time and frequency domain analysis of signals. Digital processing techniques. Laboratory work involving analysis of actual ocean engineering related signals using data acquisition systems such as the H.P. Fourier Analyzer.

Electro-Mechanics, Electrical Machines, and Analog Electronics (EOC 3636) 3 credits

Prerequisite: EEL 3111

Designed for Ocean Engineering majors, the course deals with fundamentals of electrical and electronic machines; theory of operational amplifiers and filters; semi-conductors, diodes and transistors; and electronic instruments and measurements.

Materials I – Marine Topics (EOC 3930) 1 credit

Prerequisite: EOC 3141; Corequisite: EOC 3200

Introduction to atmospheric and submerged marine corrosion. Corrosion prevention methods. An introduction to cathodic protection. Introduction to fracture and fracture control in marine environments. Materials and devices for energy storage, primary/secondary batteries, fuel cells. Composite materials for marine applications.

Acoustics II (EOC 4115C) 4 credits

Prerequisite: EOC 3306

Sonar equations, underwater sound propagation, sonar system performance and design.

Fluid Mechanics II (EOC 4124) 4 credits

Prerequisite: EOC 4422

The second course of a two-semester study of incompressible-fluid flow and its application to ocean engineering with emphasis on: fluid properties, hydrostatic forces, buoyancy and stability of floating bodies including metacentric height concepts, fluid dynamics, dimensional analysis, modeling, real flows in closed conduits and open channels, boundary-layers, lift and drag, turbo-machines, computational and experimental methods, resistance and propulsion of marine vehicles, and design problems.

Ocean Thermal Systems (EOC 4193) 3 credits

Prerequisite: EOC 3141; Corequisite: EOC 3123

Basic concepts of heat and mass transfer concepts with application to the ocean and ocean systems. Applications will include power cycles and heat exchangers in ocean systems. The interactive environmental processes involving solar radiation, convective ocean circulation, evaporation and mixtures will be considered.

Engineering Materials II (EOC 4201C) 4 credits

Prerequisite: EOC 3200

Materials selection for marine applications. Atmospheric and submerged marine corrosion. Corrosion prevention and fracture and failure analysis. Materials and devices for energy storage, primary/secondary batteries, fuel cells and electrochemical capacitors. Composite materials, strengthening mechanisms.

Structural Analysis II (EOC 4412) 4 credits

Prerequisite: EOC 3410C

Matrix and finite-element methods, environmental loading, stability, and dynamics of floating body applied to ocean structures.

Ocean Wave Mechanics (EOC 4422) 3 credits

Prerequisites: EOC 3114, 3123

Small amplitude wave theory, finite amplitude waves, wave generation, wave forecasting, wave measurements. Wave force on fixed structures, floating bodies and moored bodies.

Dynamic Systems (EOC 4620) 3 credits

Prerequisite: EOC 3114, COP 2220

Course examines mathematical modeling of dynamic systems, linear systems analysis in the time and frequency domains, and analysis and design of control systems. Students are also exposed to practical control implementation issues through real time control experiments.

Ocean Engineering Systems Control and Design (EOC 4804) 3 credits

Prerequisites: All 3000-level core engineering courses required by department, except EOC 3631C; Corequisite: EOC 3631C

Ocean engineering design, creativity and professionalism. Ocean systems design, simulation and control. Dynamic modeling, system trade-offs and system evaluation. Feasibility, preliminary and final design for project to be completed in EOC 4804L.

Ocean Engineering Systems Control and Design Project (EOC 4804L) 4 credits

Prerequisite: EOC 4804

Completion and execution of the system design project developed in previous EOC 4804 including detail design, final design, fabrication, testing, evaluation, and reporting of results in written and oral form.

Directed Independent Study (EOC 4905) 1-3 credits

Prerequisite: Permission of instructor

Special Topics (EOC 4930) 1-4 credits

Prerequisite: Permission of instructor

New developments in Ocean Engineering and related areas.

Co-operative Education - Ocean Engineering I & II (EOC 4949) 1-3 credits

Prerequisite: Successful completion of one semester of upper-level ocean engineering curriculum

Cooperative work-study with ocean oriented organizations for ocean engineering students who have completed at least one full semester of upper-level Ocean Engineering. On-the-job training and instruction. May be repeated once for credit. These credits do not count toward the bachelor's degree. *Grading: S/U*

Introduction to Oceanography (OCE 2001) 3 credits

(Note: Ocean Engineering majors may not take this course for credit.) A survey course exploring the origin of ocean basins, continents, sea water and physical, chemical, geological and meteorological oceanography. This course may be used for majors other than Ocean Engineering to partially meet the Natural Science component of the core or general education requirements.

Oceanography (OCG 3002) 3 credits

Prerequisite: CHM 2045

Nature of sea water; trace and major constituents; the ocean carbon, phosphorous, and nitrogen cycles; basins, continental shelf, deep ocean floor; thermal vents, manganese nodules, marine sediments; marine life; plate tectonics; estuaries and mixing processes; pollution; corrosion and biofouling; winds, waves, tides, currents and ocean circulation processes; energy (heat, light, sound); depth, temperature, salinity, and other physical effects.

OCG 3002 changing to OCE 3008 in fall of 2007.

EOC 3930 changing to EOC 3213 in fall of 2007.

EOC 4115C changing to EOC 4307C in fall of 2007.

Graduate Courses

Mathematical Methods in Ocean Engineering I (EOC 5172) 3 credits

Prerequisite: Permission of instructor

First of a two-course sequence of mathematical methods in solving ocean engineering problems in hydrodynamics, vehicle dynamics, acoustics and vibrations, ocean structures, and electrical and mechanical systems.

Advanced Mechanics of Materials in Ocean Applications (EOC 6152) 3 credits

Prerequisite: EOC 3150

Thin- and thick-walled cylinders under external hydrostatic ocean pressure; beams on elastic foundations; energy methods, handling hooks and curved beams; contact stresses; buckling problems; inelastic behavior of beams; theories of failure.

Theory of Plates (EOC 6153) 3 credits

Prerequisite: EOC 3150 or EGM 3524

Plate elements in ocean structures and analysis and design of plate structures. It includes linear theory, large deflection theory, and the effects of shear deformation.

Theory of Elasticity (EOC 6154) 3 credits

Prerequisite: EOC 3150 or EGM 3524

The classical formulation of the mathematical expressions for states of stress and strain in a three-dimensional medium. Constitutive relations for linearly elastic materials, solid bodies as boundary value problem, plane stress and plane strain, and deep submergence effect on yield surface.

Finite Element Methods (EOC 6155) 3 credits

Prerequisite: EOC 3150 or EGM 3524

The finite element approach to the solution of elasticity problems. Emphasis on displacement method, using direct stiffness approach for generation of overall stiffness matrix of a structure. Energy method for elemental stiffness matrices.

Advanced Fracture and Failure Processes I (EOC 6157) 3 credits

Prerequisites: EOC 6216C, EOC 6230, or permission of instructor

Advanced treatment of microscopic and macroscopic theories of plastic deformation, strengthening mechanisms, and fracture; fracture mechanics, fatigue and environmental cracking, stress corrosion cracking, corrosion fatigue and hydrogen embrittlement. Emphasis is on materials employed in structural marine applications.

Mathematical Methods in Ocean Engineering II (EOC 6174) 3 credits

Prerequisite: EOC 5172

Second of a two-course sequence of mathematical methods in solving ocean engineering problems in hydrodynamics, vehicle dynamics, acoustics and vibrations, ocean structures, and electrical and mechanical systems.

Vortex Dynamics (EOC 6184) 3 credits

Prerequisite: Permission of Instructor

Fundamental properties of vorticity, vortex sheets, vortex momentum, dynamics of vortex sheets, point vortices, vortex patches and vortex filaments, vortex rings, vortex instability, viscous effects, vortex sound, tornadoes and hurricanes.

Advanced Hydrodynamics I (EOC 6185) 3 credits

Prerequisite: Graduate standing or permission of instructor

A two-semester sequence providing a comprehensive and rigorous background in hydrodynamics for ocean engineering

graduate students. The course will cover development of basic equations and fundamental approximations, potential flow, low and high Reynold's number flows, turbulence, and boundary layers. It employs basic analytic and numerical methods of problem solving.

Advanced Hydrodynamics II (EOC 6186) 3 credits

Prerequisites: PHZ 4113, EOC 6185

The second course in a two-semester sequence providing a comprehensive and rigorous background in hydrodynamics for ocean engineering graduate students. The course will cover development of basic equations and fundamental approximations, potential flow, low and high Reynold's number flows, turbulence, and boundary layers. Basic analytic and numerical methods of problem solving are used.

Computational Fluid Dynamics (EOC 6189) 3 credits

Prerequisites: PHZ 4113 and either EOC 6185 and EOC 6186 or EML 6715

A systematic instruction of computing techniques for fluid flow including fundamentals of computational fluid dynamics, finite difference methods for incompressible flow, finite element simulation, and numerical methods in free-surface flow.

Turbulent Flow (EOC 6190) 3 credits

Prerequisites: PHZ 4113 and either EOC 6185 and EOC 6186 or EML 6715

An introduction to turbulent transport of momentum and heat, the dynamics of turbulence, wall-bounded shear flows, boundary-free shear flows, turbulent diffusion, shear flow dispersion.

Composite Materials (EOC 6205) 3 credits

Prerequisite: Permission of instructor

The use of composite materials in engineering applications: nonisotropic mechanical behavior, micromechanical behavior of lamina and fibers, bending, buckling, and vibration of composite materials, matrix and reinforcement materials for composites, manufacturing techniques for composite materials.

Corrosion I (EOC 6216C) 3 credits

Prerequisite: Graduate standing

Theory of corrosion with regard to electrode potential, polarization and passivity, and corrosion prevention; techniques in corrosion research; corrosion and corrosion prevention in the marine environment.

Corrosion II (EOC 6218C) 3 credits

Prerequisite: EOC 6216C

The theory of corrosion with regard to electrode potentials, polarization, and passivity as well as corrosion prevention. It covers techniques in corrosion research; corrosion and corrosion prevention in the marine environment.

Physical Metallurgy (EOC 6230) 3 credits

Prerequisite: Permission of instructor

The theoretical aspects of physical metallurgy: the structure of atoms and crystals, laboratory techniques, thermodynamics of metals, structure of alloys, dislocation theory.

Sonar System Designs (EOC 6310) 3 credits

Prerequisites: MAP 2302 and EEL 3003 or EEL 3341C

Transduction, electromechanical equivalent circuits, sonar equations, radiation, transmission loss, reverberation, target strength, noise sources and fields, telemetry, signal detection, acoustic signal processing, beam forming, modeling sonar signals, sonar performance, transceiver electronics.

Flow Noise (EOC 6311C) 3 credits

Prerequisite: PHZ 4113, EOC 6185 or equivalent
 Sound generation by flow, Lighthill's analogy, dipole and quadrupole noise, noise and unsteady loading from propellers, blade response functions, trailing edge noise, ducted propellers, propagating modes, sound power calculations with flow.

Structural Acoustics and Vibrations (EOC 6316) 3 credits

Prerequisites: EOC 6310, EOC 6425
 Study of the techniques in noise and vibration control at source, using power flow methods and the development of an energy balance to relate the radiated noise to the structural parameters.

Engineering Principles of Acoustics (EOC 6317C) 3 credits

Prerequisite: Permission of instructor
 The physical principle of acoustics, governing equations and their solutions, bounded and unbounded media, sources, sound generation propagation and measurement.

Advanced Ocean Wave Mechanics (EOC 6320) 3 credits

Prerequisite: PHZ 4113
 Linear and nonlinear wave theory, nearshore ocean wave dynamics, hydrodynamics of floating bodies, the introduction of wave stability and solutions.

Plastic Analysis of Structures (EOC 6416) 3 credits

Prerequisite: EOC 6152
 Yield criteria, limit theorems, Static Plastic collapse of beams, frames, plates, shells, shell intersections and other structures encountered in ocean engineering and naval architecture. It discusses the yield line theory for reinforced concrete and introduces limit analysis in soil mechanics.

Ocean Structural Dynamics (EOC 6425) 3 credits

Prerequisite: EOC 3114
 Methods of analysis for elastic ocean frames subject to time dependent loading, at the vibration theory applied to structural systems, and at modes of vibration, energy methods, and damping.

Coastal Structures (EOC 6430) 3 credits

Prerequisite: EOC 6152
 An overview of basic concepts: environmental loading, seawalls, bulkheads and revetments, groins, jetties, breakwaters and cylindrical structures, wharves, quays, fenders, dolphins, and mooring devices, littoral drift and sedimentation problems, planning of coastal protection.

Offshore Structures (EOC 6431) 3 credits

Prerequisite: EOC 6152
 Basic structural systems, environmental loading, fixed and gravity type platforms, semi-submersibles, floating and compliant platforms, external pressure shell structures including oil storage tanks, pipelines, wet and dry subsea completion systems, buoy engineering, concepts for frontier areas, dynamic response.

Marine Geotechnical Engineering (EOC 6435) 3 credits

Prerequisite: EOC 6431
 Seabed exploration, pile foundations for fixed platforms, analyzes axially and laterally loaded piles, deals with penetration resistance of gravity platforms and storage tanks, jackup platform stability, anchoring of floating structures, pipelines and finite elements, and analyses of soil-structure interaction.

Signal Processing (EOC 6630) 3 credits

Prerequisite: Graduate standing or permission of instructor
 Theory of information processing with particular applications in the fields of communication and sonar.

Engineering Data Analysis (EOC 6635) 3 credits

Fourier transform applications to the processing of ocean engineering related types of signals, time and frequency domain analysis of signals, signal processing techniques, laboratory work involving actual ocean time series data using modern data acquisition systems.

Intelligent Underwater Vehicles I (EOC 6663) 3 credits

Prerequisites: STA 4032, EEL 3003
 Engineering principles for intelligent, unmanned, untethered, underwater vehicles (IU³ vehicles). Topics include vehicle kinematics; and tasks, behavior, locomotion, power sources and sensors.

Fuzzy Logic Control Systems (EOC 6681) 3 credits

Prerequisites: EEL 4652, computer programming experience
 Fundamentals of Fuzzy Set Theory and Fuzzy Logic; calculus of Fuzzy IF-THEN Rules; Fuzzy Control Theory and Techniques including design, analysis, and implementation; applications of Fuzzy Logic Control Systems.

Directed Independent Study (EOC 6908) 1-3 credits

Reading and research on selected appropriate topics.

Special Topics (EOC 6934) 1-3 credits

Prerequisite: Permission of instructor
 New developments and advanced work in specialized areas of ocean engineering designed for individual student interest.

Dissertation (EOC 7980) 1-15 credits

Grading: S/U

Master's Thesis (OCE 6971) 1-10 credits

Grading: S/U

Physical Aspects of Oceanography (OCP 6050) 3 credits

Prerequisite: Admission to graduate program in Ocean Engineering
 A critical review of physical, chemical, and geological oceanography. Extensive assigned reading, seminars, etc. are required.

EOC 6316 is no longer offered at FAU, eff. summer of 2006.

EOC 6425 is no longer offered at FAU, eff. summer of 2006.