OCEN - OCEAN ENGINEERING (OCEN)

OCEN 201 Introduction to Ocean Engineering

Credits 3. 3 Lecture Hours. Survey of ocean engineering; concepts and theories of wave-structure interaction; sources of technical information; coastal and ocean structures, moorings, laboratory models; underwater systems; naval architecture; ocean instrumentation; materials and corrosion; hydrographic surveying and positioning, graphics laboratory, recent developments in ocean engineering. **Prerequisite:** Ocean engineering majors.

OCEN 213 Principles of Materials Engineering

Credits 3. 2 Lecture Hours. 2 Lab Hours. Description of properties of materials using a unified approach; discussion of the chemical structure, crystalline structure, microstructure, interface structure, and phase diagrams for materials; develop bulk properties and characteristics of metals, polymers, and ceramics; mechanical, electrical, magnetic, thermal, and optical properties for these materials. **Prerequisite:** Ocean Engineering majors.

OCEN 214 Mechanics of Deformable Bodies

Credits 3. 3 Lecture Hours. Concepts of stress, strain and deformation; factor of safety; stress-strain relationships and material properties; stress concentrations; area moments of inertia; axially loaded members, torsionally loaded members, bending of beams; shear and moment diagrams; stresses due to combined loading; thin-walled pressure vessels; transformation of stress including Mohr's circle; beam deflections and buckling stability. **Prerequisites:** Grade of C or better in OCEN 221; grade of C or better in MATH 308 or concurrent enrollment.

OCEN 221 Engineering Mechanics - Statics

Credits 3. 3 Lecture Hours. General principles of mechanics; concurrent force systems; statics of particles; equivalent force/moment systems; centroids and center of gravity; equilibrium of rigid bodies; trusses, frames and machines; internal forces in structural members; moments of areas. **Prerequisite:** Grade of C or better in MATH 251 or MATH 253, or concurrent enrollment; also taught at Galveston campus.

OCEN 265 Introduction to Geotechnical Engineering

Credits 3. 2 Lecture Hours. 2 Lab Hours. Physical properties of soils, classification systems, soil exploration, permeability, consolidation, compaction and shear strength; laboratory tests conducted to determine the physical and engineering soil properties needed for application in geotechnical engineering design. **Prerequisite:** Grade of C or better in OCEN 214 or CVEN 305.

OCEN 285 Directed Studies

Credits 1 to 4. 1 to 4 Other Hours. Directed study on selected current problems in the ocean and/or maritime industry; enables individuals or groups to undertake and complete with credit some specialized investigation not covered by other courses. **Prerequisite:** Approval of department head.

OCEN 300 Ocean Engineering Wave Mechanics

Credits 3. 3 Lecture Hours. Physical and mathematical fundamentals of ocean wave behavior; mechanics of wave motion; use of statistics and probability to develop design wave criteria. **Prerequisite:** Grade of C or better in OCEN 311; grade of C or better in OCEN 362 or concurrent enrollment.

OCEN 311 Fluid Statics and Dynamics

Credits 3. 3 Lecture Hours. Fluid properties; statics; kinematics; ideal gas law; conservation of mass; linear momentum and Newton's Second Law; conservation of energy; Bernoulli's equation; control volume analysis, similitude and hydraulic models; homogeneous flow in pipes; fluid drag, boundary layer basics. **Prerequisite:** Grade of C or better in OCEN 221.

OCEN 336 Fluid Dynamics Laboratory

Credit 1. 2 Lab Hours. Introduction to laboratory techniques, calibration principles, reports and fluid measurements; determination of fluid properties; visualization of types of flow; experiments in closed conduit flow of air, water and oil; fluid drag and turbomachinery tests; open channel and gravity wave demonstrations. **Prerequisite:** Grade of C or better in OCEN 311 or CVEN 311/EVEN 311, or concurrent enrollment.

OCEN 341 Engineering Economics and Project Management

Credits 3. 3 Lecture Hours. Analysis of engineering economics and management, using costs and benefits of various engineering options; project scheduling covered in detail including PERT, GANT and CPM methods; time value of money, cash flows, analysis techniques, interest rates, inflation, depreciation, optimization, statistics, network analysis and critical path programming. **Prerequisites:** Junior or senior classification; enrollment in the OCEN program; also taught at Galveston campus.

OCEN 344 Reinforced Concrete Structures

Credits 3. 3 Lecture Hours. Analysis and design of reinforced concrete beams, columns, slabs and footings using ultimate strength methods. **Prerequisites:** Grade of C or better in OCEN 345 and OCEN 213; also taught at Galveston campus.

OCEN 345 Theory of Ocean Engineering Structures

Credits 3. 3 Lecture Hours. Functions of and loadings on ocean engineering structures, including sea walls, harbor structures, sea-going vessels, offshore structures and underwater vehicles; analysis of structures including trusses, beams, plates, shells and arches; introduction to stress and failure analysis; introduction to finite element analysis (FEA) including computational mechanics of ocean engineering structures using FEA. **Prerequisite:** Grade of C or better in OCEN 214.

OCEN 351 Rigid Body Dynamics For Ocean Engineers

Credits 3. 3 Lecture Hours. General principles in mechanics; position, velocity and acceleration; application of Newton's laws to rigid body dynamics; kinematics of rectilinear and curvilinear motions; stationary and moving frames of reference; work-energy and impulse momentum principles for applications to ocean engineering systems. **Prerequisites:** Grade of C or better in MATH 308 or concurrent enrollment; grade of C or better in OCEN 221.

OCEN 352 Vibrations and Control for Ocean Engineers

Credits 3. 3 Lecture Hours. Fundamentals of mechanical vibration; vibration responses to harmonic and random excitations; vibration of single-degree-of-freedom and multiple-degree-of-freedom; modal analysis and resonance; optimum control theories and examples; state-space representation; applications of the optimum feedback control; compensator design using Separation Principle. **Prerequisite:** Grade of C or better in OCEN 351.

OCEN 361 Applied Numerical Methods

Credits 3. 3 Lecture Hours. Application of numerical methods to ocean-related engineering problems; development, evaluation and comparison of various techniques for root finding, curve fitting, numerical integration, simultaneous linear algebraic equations, matrix methods, probability and statistics and ordinary differential equations in ocean-related engineering applications. **Prerequisite:** Grade of C or better in MATH 308 or concurrent enrollment.

OCEN 362 Hydromechanics

Credits 3. 3 Lecture Hours. Kinematics of fluids; differential analysis of fluid flow; homogeneous, incompressible, irrotational and turbulent flows; Euler equations; Navier-Stokes equations; flow of viscous fluids; pumps; introduction to water waves. **Prerequisites:** Grade of C or better in OCEN 311 and MATH 308.

OCEN 363 Dynamics and Vibrations

Credits 3. 3 Lecture Hours. Application of Newtonian and energy methods to model dynamic systems with ordinary differential equations; dynamics and vibrations of linear single-and multi-degree of freedom systems of particles and rigid bodies; solutions of models using analytical approaches; interpreting solutions; application to simple floating systems. **Prerequisites:** Grade of C or better in OCEN 221; grade of C or better in MATH 308 or concurrent enrollment.

OCEN 399 Leadership and Experience

Credits 0. 0 Other Hours. Participation in an approved high-impact learning practice; reflection on professional outcomes from engineering body of knowledge; documentation and self-assessment of learning experience at mid-curriculum point. **Prerequisites:** OCEN 201; junior or senior classification or approval of instructor.

OCEN 400 Basic Coastal Engineering

Credits 3. 3 Lecture Hours. Mechanics of wave motion; wave refraction, diffraction and reflection; wave forecasting; shore processes; planning of coastal engineering projects; design of seawalls, breakwaters, beach nourishment and fixed and floating installations; dredging; risk analysis. **Prerequisites:** Grade of C or better in OCEN 300.

OCEN 401 Underwater Acoustics for Ocean Engineers

Credits 3. 3 Lecture Hours. Fundamentals of underwater acoustics, SONAR equations, propagation of underwater sound, acoustic transducers and arrays, noise in the ocean environment, design and prediction of SONAR systems, ocean engineering applications of underwater sound. **Prerequisite:** Grade of C or better in OCEN 311.

OCEN 402 Principles of Naval Architecture

Credits 3. 3 Lecture Hours. Elementary principles of naval architecture; ship geometry and hydrostatics; load line and classification regulations; concept of intact and damaged stability; resistance and propulsion of water-borne vehicles; applications to the design consideration of semi-submersibles, catamarans and drilling rigs. **Prerequisite:** Grade of C or better in OCEN 311.

OCEN 403 Dynamics of Offshore Structures

Credits 3. 3 Lecture Hours. Prediction of loads due to wind, current and waves; introduction to concepts of linear structural dynamics and to the design of ocean structures; mooring and towing analysis; fluid-structure interactions; vibration of submerged structures; offshore pipelines; introduction to risk analysis. **Prerequisite:** Grade of C or better in OCEN 300 , OCEN 345, and OCEN 362; grade of C or better in OCEN 363 or concurrent enrollment.

OCEN 405 Finite Element Analysis in Engineering Design

Credits 3. 3 Lecture Hours. Introduction to the fundamental theory and techniques; direct approach and energy formulation; element equations, assembly and solution schemes; computer implementation, design considerations; applications to field problems; original computer project required. **Prerequisite:** Grade of C or better in OCEN 345.

OCEN 406 Capstone Design I

Credit 1. 1 Lecture Hour. Part one of a two-course sequence; development and presentation of detailed proposals for offshore or coastal engineering projects, which will form the basis for OCEN 407 design projects; includes formulation of project objectives, design constraints, delineation of alternatives, scheduling and analysis of economic and environmental impact. **Prerequisites:** Grade of C or better in OCEN 300; grade of C or better in OCEN 400, OCEN 402, and OCEN 403, or concurrent enrollment.

OCEN 407 Design of Ocean Engineering Facilities II

Credits 3. 0 Lecture Hours. 6 Lab Hours. Design of structures, equipment and systems for the ocean; environmental, logistical and reliability requirements; complete design process followed through group design project; delineation of alternatives, constraints, economics and environmental consequences included to strengthen real-life problem solving skills. **Prerequisites:** Grade of C or better in OCEN 400, OCEN 402, OCEN 403, and OCEN 406.

OCEN 408 Underwater and Moored System Design

Credits 3. 3 Lecture Hours. Basic principles of thermodynamics, fluid dynamics and human respiration physiology applied to design of underwater habitats, submersibles and diving bells; breathing gas supply for diving systems; heat transfer for underwater systems; pressure vessel design; remotely operated vehicles; subsea flowlines and manifold systems; and design of towed and moored systems. **Prerequisite:** Grade of C or better in OCEN 311.

OCEN 410 Ocean Engineering Laboratory

Credits 2. 1 Lecture Hour. 2 Lab Hours. Fundamental techniques and instrumentation for field and laboratory measurements pertaining to ocean engineering experiment planning; data analysis and data presentation; written reports describing planning, analysis and results of experiments. **Prerequisites:** Grade of C or better in OCEN 400, OCEN 402, and OCEN 403.

OCEN 411 Environmental Nearshore Hydrodynamics

Credits 3. 3 Lecture Hours. Fundamentals of current and shallow water wave motions; beach response to nearshore processes; coastal sediment and pollutant transport including nearshore currents, longshore onshore-offshore transport and shoreline configuration; facilities for shoreline stabilization, backshore protection and inlet stabilization; environmentally conscious coastal engineering design. **Prerequisites:** Grade of C or better in OCEN 300.

OCEN 415 Offshore Structure Design

Credits 3. 3 Lecture Hours. Design of large structures using diffraction analysis; design project: design of a fixed offshore structure including dynamics effects. **Prerequisite:** Grade of C or better in OCEN 345, or concurrent enrollment.

OCEN 421 Naval Architecture Design II

Credits 3. 2 Lecture Hours. 3 Lab Hours. Ship motion and mooring; theory and practice of naval architecture, basic principles and design calculations; hull structural design considerations; ship resistance and propulsion power prediction; propeller selection concepts; dynamic positioning systems; mobile offshore drilling unit (MODU) design considerations; practical design work on a vessel or MODU of the student's choosing under the guidance of the instructor. **Prerequisites:** Grade of C or better in OCEN 362 and OCEN 402.

OCEN 451 Robotic Marine Vehicles for Ocean Engineers

Credits 3. 3 Lecture Hours. Theoretical and practical overview of robotic marine vehicles, including both surface and subsurface vehicles, operating in remote and coastal areas; design and deployment of seaborne robotic systems; hydrodynamic and hydrostatic properties of the vessel, the propulsion, control system and navigation strategies and path planning; underwater acoustics, focusing on the fundamentals necessary to design and predict SONAR performance for underwater communications and obstacle avoidance. **Prerequisite:** Grade of C or better in OCEN 311.

OCEN 459 Mechanical Vibrations

Credits 3. 3 Lecture Hours. Basic theory of vibrating systems with single and multiple degrees of freedom and principles of transmission and isolation of vibrations. **Prerequisites:** Grade of C or better in OCEN 361 and OCEN 363.

OCEN 460 Data Science for Ocean Engineers

Credits 3. 3 Lecture Hours. Engineering analysis of large amounts of complex raw and processed information; identifying data patterns and surveying well-known data science techniques; communicating through the language of data science; constructing prototype data analytics pipelines demonstrations **Prerequisite:** Junior or senior classification; approval of instructor.

OCEN 461 Ocean Instrumentation and Control Theory

Credits 3. 3 Lecture Hours. Electrical systems components; analog and digital filters-amplifiers; network analysis; instrument behavior and displacement, velocity, acceleration, force, and flow measurements; simple feedback and control theory for linear electromechanical systems; digital data acquisition. **Prerequisites:** Grade of C or better in ECEN 215.

OCEN 463 Hydrodynamics of Offshore Structures

Credits 3. 3 Lecture Hours. Introduction to offshore structures; wave force formulation; wave forces on small structures; floating structure dynamics; modeling dynamics systems of rigid body motion; structure response statistics. **Prerequisite:** Grade of C or better in OCEN 345 and OCEN 363.

OCEN 465 Subsea Pipeline Design

Credits 3. 3 Lecture Hours. Design and construction practices of submarine oil/gas pipelines and risers; pipe selections, coating, insulation; route selection; operation and installation stresses; stability during laying and operation due to wave and current action; cost analysis considering long term operability and safety. **Prerequisite:** Grade of C or better in OCEN 300.

OCEN 467 Offshore Random Processes

Credits 3. 3 Lecture Hours. Basic probability theory and engineering statistics; irregular structural excitation and response; random vibration theory with application to offshore processes and structures; development of extreme values used in design of ocean structures. **Prerequisites:** Grade of C or better in OCEN 361, OCEN 363, and OCEN 403; also taught at Galveston campus.

OCEN 474 Port and Harbor Engineering

Credits 3. 3 Lecture Hours. Engineering background and specific skills for design of marine facilities and harbors; includes development of design criteria, channel design, evaluation of operations and extreme loads, dredging and disposal. **Prerequisites:** Junior or senior classification or approval of instructor.

OCEN 481 Seminar

Credit 1. 1 Lecture Hour. Responsibilities and obligations of new ocean engineers; professional ethics, membership in professional societies and professional registrations; case studies and lectures presented by staff and practicing engineers. Must be taken on a satisfactory/unsatisfactory basis. **Prerequisite:** Grade of C or better in OCEN 406.

OCEN 485 Directed Studies

Credits 1 to 6. 1 to 6 Other Hours. Special problems in various areas of ocean engineering assigned to individual students or to groups; readings and assignments given and frequent consultations held. **Prerequisite:** Approval of program head.

OCEN 489 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. Selected topics in an identified field of ocean engineering. May be repeated for credit. **Prerequisite:** Approval of instructor.

OCEN 491 Research

Credits 1 to 4. 1 to 4 Other Hours. Research conducted under the direction of faculty member in ocean engineering. May be repeated 2 times for credit. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded. **Prerequisites:** Approval of instructor.