DEPARTMENT OF OCEAN ENGINEERING

Ocean Engineering

Ocean engineering is the application of basic engineering principles to the analysis, design, construction, and management of systems that operate in the ocean environment or near shore. Typical ocean engineering application areas include: beach protection and nourishment, coastal structures and erosion, wave and current structure interaction, development of ocean energy resources, instrumentation for coastal and offshore measurements, marine dredging and dredged material placement, ocean mining, offshore petroleum recovery, offshore structures and vessels, marine hydrodynamics, marine risers, moored and towed systems, numerical and physical modeling, ports and harbors, remotely operated and autonomous underwater vehicles, renewable ocean energy systems, search and salvage, suspended and dissolved constituent transport, subsea pipelines and cables, seafloor pipeline and umbilical layouts, flow assurance, submersible vehicles, sustainable and resilient ocean systems, and underwater acoustics. Employment opportunities exist with private industry, defense contractors, consulting firms, and government agencies. Ocean engineering students are encouraged to pursue summer internships and may participate in the University cooperative education program and the study abroad program. The undergraduate program in ocean engineering in the Department of Ocean Engineering at Texas A&M University is accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

The mission of the Ocean Engineering Program is to conduct research, serve the public, and educate students in a broad program of instruction encompassing traditional and emerging areas of ocean engineering. Graduates are prepared for entering engineering practice, continuing onto graduate study, life-long learning and professional development. Students develop a sense of professionalism and an appreciation for the obligations of a professional engineer. The Program offers ocean engineering continuing education activities for the people and marine industry of the state, nation and international community. The Program serves the public and engineering profession in Texas and the nation through participation of faculty and students in public and professional activities. Applied and fundamental research is conducted that contributes to the better understanding of ocean engineering and supports student educational development.

The program educational objectives of the Ocean Engineering Program are:

1. Graduates contribute to the ocean engineering profession and society.
2. Graduates gain employment in ocean engineering and related engineering fields with private and government organizations.
3. Graduates advance to positions of increased responsibility and develop professionally through training, technical conferences, and continuing education activities.
4. Some graduates become professional engineers and members of ocean engineering related professional societies.
5. Some graduates pursue graduate studies in ocean engineering and related fields and receive post baccalaureate degrees.

The laboratory facilities accessible to the Department of Ocean Engineering are among the most comprehensive in the nation for testing offshore, dredging and coastal systems. The College Station facilities are located in the Reta and Bill Haynes ’46 Coastal Engineering Laboratory, the Offshore Technology Research Center and the Civil Engineering Laboratory Building. These facilities include a large deep water wave basin, a towing tank and model dredge, a wave channel, fluid dynamics laboratory equipment, a shallow water wave basin and data acquisition systems. The facilities in Galveston include naval architecture, fluid dynamics, and geotechnical experimental equipment, and two wave channels. The Galveston campus also provides access to the Gulf of Mexico through the use of small boats and research vessels that are available for education and research. Additional information is available on the Department of Ocean Engineering website: http://engineering.tamu.edu/ocean.

Before commencing course work in the major, students must be admitted to the major or have the approval of the department head.

Faculty

Carney, Sara E, Assistant Lecturer
Ocean Engineering
MS, Texas A&M University, 2016

Falzarano, Jeffrey M, Professor
Ocean Engineering
PHD, University of Michigan, 1990

Figlus, Jens, Assistant Professor
Ocean Engineering
PHD, University of Delaware, 2010

Girimaji, Sharath S, Professor
Ocean Engineering
PHD, Cornell University, 1990

Gordon, Robert B, Senior Lecturer
Ocean Engineering
PHD, University of Rhode Island, 1982

Greer, Matthew N, Senior Lecturer
Ocean Engineering
MS, Massachusetts Institute of Technology, 1979

Horrillo, Juan J, Associate Professor
Ocean Engineering
PHD, University of Alaska Fairbanks, 2006

Kang, Heonyong, Research Assistant Professor
Ocean Engineering
PHD, Texas A&M University, 2014

Kian, Rozita, Research Assistant Professor
Ocean Engineering
PHD, Middle East Technical University, 2015

Kim, Moohyun, Professor
Ocean Engineering
PHD, Massachusetts Institute of Technology, 1988
Koola, Paul M, Professor of the Practice
Ocean Engineering
MBA, Texas A&M University, 2000
PHD, Indian Institute of Technology, Madras, 1991

Na, Byoungjoon, Research Assistant Professor
Ocean Engineering
PHD, Texas A&M University, 2010

Parihar, Arun, Lecturer
Ocean Engineering
MS, University of Houston, 2008

Perlin, Marc, Professor
Ocean Engineering
PHD, University of Florida, 1989

Randall, Robert E, Professor
Ocean Engineering
PHD, University of Rhode Island, 1972

Rodriguez, Ignacio J, Distinguished Professor
Ocean Engineering
PHD, Colorado State University, 1967

Shaw, Surupa, Lecturer
Ocean Engineering
PHD, University of New Hampshire, 2015

Subramanian, Rahul, Lecturer
Ocean Engineering
PHD, University of Michigan, 2012

Sweetman, John A, Professor
Ocean Engineering
PHD, Stanford University, 2001

Wood, Amanda L, Instructional Assistant Professor
Ocean Engineering
PHD, University of Houston, 2010

Majors
• Bachelor of Science in Ocean Engineering (http://catalog.tamu.edu/undergraduate/engineering/ocean/ocean-engineering-bs)

Courses

OCEN 100 Introduction to Offshore and Coastal Engineering
Credits 2. 2 Lecture Hours.
Introduction to offshore and coastal engineering principles with emphasis on offshore structures, underwater pipelines, floating production systems, current advances in offshore technologies; coastal structures, coastal processes, port and harbor design and advances in ocean/wind energy technologies.
Prerequisites: MATH 151 or concurrent enrollment; freshman and sophomore classification.

OCEN 201 Introduction to Ocean Engineering
Credits 3. 2 Lecture Hours. 2 Lab 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: OCEN 221 or concurrent enrollment.

OCEN 210 Properties of Engineering Materials
Credit 1. 3 Lab Hours.
Atomic and crystalline structures of materials; mechanical properties, failure, corrosion and thermal processes of metallic materials; tensile, hardness, impact and torsion testing of metal alloys.
Prerequisites: ENGR 212, ENGR 221 and PHYS 208.

OCEN 212 Engineering Science in Thermodynamics
Credits 3. 2 Lecture Hours. 3 Lab Hours.
Theory and application of thermodynamics as an engineering science; applications of the laws of thermodynamics and energy equations to heat transfer and flow.
Prerequisites: ENGR 221 and MATH 251 or concurrent enrollment.

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.
Prerequisites: CHEM 107, CHEM 117; OCEN 221; OCEN 216; PHYS 208; MATH 308 or concurrent enrollment.

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: ENGR 221; MATH 308 or concurrent enrollment.

OCEN 215 Principles of Electrical Engineering
Credits 3. 2 Lecture Hours. 2 Lab Hours.
Fundamentals of electric circuit analysis, AC power, and electronics; intended as a terminal course in these areas for most engineering disciplines.
Prerequisites: PHYS 208, MATH 308 or concurrent enrollment.

OCEN 216 Principles of Thermodynamics
Credits 2. 2 Lecture Hours.
Theory and application of thermodynamics as an engineering science; study of work, heat and energy as applied to open and closed systems; introduction to entropy, reversible and irreversible processes; intended as a terminal course in these areas.
Prerequisites: ENGR 221 and MATH 251 or concurrent enrollment.

OCEN 217 Electrical Engineering: Circuits
Credits 2. 2 Lecture Hours.
Fundamental principles of electric circuit analysis, DC and AC electricity, electric power; designed to prepare for topical questions from the P.E. exam; intended as a terminal course in these areas.
Prerequisite: PHYS 208.
OCEN 221 Engineering Mechanics: Statics  
Credits 3. 2 Lecture Hours. 2 Lab 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.  
Prerequisites: ENGR 111; MATH 251 or MATH 253 or concurrent enrollment; PHYS 218; enrollment in OCSL or OCSE major degree sequence.

OCEN 261 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.  
Prerequisites: MATH 308 or concurrent enrollment, ENGR 111, ENGR 112.

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. Enrollment in OCSE or OCSL.  
Prerequisite: OCEN 221.

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: CVEN 311, OCEN 201 or concurrent enrollment.

OCEN 310 Engineering Analysis  
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.  
Prerequisites: Junior or senior classification or approval of instructor; MATH 308 or concurrent enrollment; ENGR 111 and ENGR 112.

OCEN 316 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: CVEN 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.

OCEN 344 Reinforced Concrete Structures  
Credits 3. 2 Lecture Hours. 3 Lab Hours.  
Analysis and design of reinforced concrete beams, columns, slabs and footings using ultimate strength methods.  
Prerequisites: Enrollment in OCEN program; CVEN 345.

OCEN 362 Hydromechanics  
Credits 3. 3 Lecture Hours.  
Kinematics of fluids; differential analysis of fluid flow; incompressible, irrotational and turbulent flow; Navier-Stokes equations; flow of viscous fluids; open-channel flow.  
Prerequisites: CVEN 311; MATH 308; junior or senior classification.

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: OCEN 221 with a grade of C or better; MATH 308 with C or better; OCEN 261; enrollment in OCSE major degree sequence and junior or senior classification.

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: OCEN 300 or approval of instructor; CVEN 311; junior or senior classification.
**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:** CVEN 311 or approval of instructor.

**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:** CVEN 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.  
**Prerequisites:** OCEN 300 or approval of instructor; CVEN 345; 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.  
**Prerequisites:** CVEN 345, OCEN 214, OCEN 261; junior or senior classification or approval of instructor; enrollment in OCEN program.

**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 MASE 407 design projects; includes formulation of project objectives, design constraints, delineation of alternatives, scheduling and analysis of economic and environmental impact.  
**Prerequisites:** OCEN 405, OCEN 415 and OCEN 463; or concurrent enrollment; ENGL 210; required 300-level engineering and technology courses; enrollment in OCSE major degree sequence.

**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:** OCEN 400, OCEN 402, OCEN 403 and OCEN 406, or approval of instructor.

**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.  
**Prerequisites:** CVEN 311; MEEN 315 or approval of instructor.

**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:** OCEN 400, OCEN 402 and OCEN 403; junior or senior classification.

**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:** OCEN 300; junior or senior classification or approval of instructor; enrollment in OCEN program.

**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.  
**Prerequisites:** OCEN 463 or concurrent enrollment; OCEN 265, CVEN 446 and OCEN 300; junior or senior classification or approval of instructor; enrollment in OCSE major degree sequence.

**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:** OCEN 319, CVEN 346, OCEN 462; junior or senior classification or approval of instructor; enrollment in OCEN program.

**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:** OCEN 214, OCEN 221, OCEN 310; junior or senior classification or approval of instructor; enrollment in OCEN program.

**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:** PHYS 208 and ENGR 215; junior or senior classification or approval of instructor; enrollment in OCEN program.
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.  
**Prerequisites:** Junior or senior classification or approval of instructor; OCEN 261, OCEN 363, CVEN 345 and OCEN 300; enrollment in OCEN program.

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.  
**Prerequisites:** CVEN 345, CVEN 365, CVEN 446, and 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:** OCEN 261, OCEN 301 and OCEN 363, or approval of instructor; enrollment in OCEN program.

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 475 Environmental Fluid Mechanics  
Credits 3. 3 Lecture Hours.  
Examines fluid and mass transport in naturally occurring flows; topics include molecular and turbulent diffusion; dispersion; river, estuary, and ocean mixing; dissolution boundary layers; tidal mixing; offshore wastewater outfalls; introduction to environmental quality numerical modeling.  
**Prerequisite:** CVEN 311.

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:** OCEN 300 or concurrent enrollment.

OCEN 482 Seminar  
Credit 1. 1 Other Hour.  
State of technology topics in ocean engineering; professional ethics, membership in professional societies and professional registrations; case studies and lectures presented by staff and practicing engineers.  
**Prerequisites:** Junior or senior classification or approval of instructor; enrollment in OCEN program.

OCEN 483 Marine Foundation Analysis and Design  
Credits 3. 2 Lecture Hours. 3 Lab Hours.  
Design of foundations for onshore, alongshore and offshore structures, including prediction of settlement and the bearing capacity of shallow and deep foundations; determination of earth pressure acting on retaining structures and design of steel and concrete bulkheads; design of pile foundations; design of cofferdams and caissons; laboratory tests conducted to determine the physical and engineering properties needed for application in geotechnical engineering design.  
**Prerequisites:** CVEN 345, CVEN 346, CVEN 365; junior or senior classification or approval of instructor; enrollment in OCEN program.

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:** Junior or senior classification and approval of instructor.