OCEN - OCEAN ENGINEERING

OCEN 615 Ocean Engineering Experiments and Oceanographic Measurements

Credits 3. 3 Lecture Hours. Applications of instrumentation and measurements through lectures during a ship-borne cruise with topics pertaining to ocean engineering including vessel/platform motions, remote operated vehicles/autonomous underwater vehicle operation, vortex induced vibrations , ocean current profiles, internal waves, geotechnical sampling, wind and meteorological data acquisition, bathythermograph measurements, conductivity/temperature/depth instrumentation, sidescan sonar and compressed high-Intensity radiated pulse, sub-bottom seismic profiling; familiarization with shipboard operations and ship-borne scientific data collection. **Prerequisites:** Undergraduate level courses including wave mechanics and one in fluid mechanics, or OCEN 671 and OCEN 678.

OCEN 621 Advanced Naval Architecture

Credits 3. 3 Lecture Hours. Analysis and prediction of resistance and propulsion of ships and self-propelled marine vehicles, dynamics and control of ships and marine vehicles in calm water and waves, maneuvering, sea-keeping, station-keeping, applying what is learned to ship-shaped and non-ship-shaped offshore structures. **Prerequisites:** OCEN 362, OCEN 402, or equivalent.

OCEN 630 Dynamics of Ocean Vehicles

Credits 3. 3 Lecture Hours. Dynamics and stability of motion of immersed and floating structures and ocean vehicles; maneuverability and control; behavior of ocean vehicles and stationary platforms in waves; design considerations leading to motion reduction; applications to surface vessels, submersibles and drilling rigs. **Prerequisites:** CVEN 311/EVEN 311, MEEN 459 or equivalent, or approval of instructor.

OCEN 640/AERO 640 Turbulence Processes

Credits 3. 3 Lecture Hours. Fundamentals of conservation, Lagrangian, transformation, variance properties; flow features: laminar, transition, turbulence regimes, characteristics, spectrum; statistical (filter/average) description: scales, Reynolds, arbitrary averaging, realizability; elementary turbulence processes: viscous, advective/inertial, role of pressure; elementary process models, viscous RDT, RDT for velocity gradients, equipartion of energy, restricted Euler equations; isotropic, homogeneous turbulence. May be repeated two times for credit. **Cross Listing:** AERO 640/OCEN 640.

OCEN 651 Elements of Natural Marine Process Design

Credits 3. 3 Lecture Hours. Engineering design applications and outcomes for individual elements typically used in managed marsh environments; elements including built hydraulic and sediment structures, as well as living marine and estuarial featuring plants, oyster reefs and grassy flats; designing effects of individual elements on hydraulic, bio-chemical, biologic and sediment processes; focusing on the selection of individual elements to meet specific design objectives on relatively small spatial- and temporal-scales. **Prerequisite:** OCEN 311, OCEN 300 or OCEN 362, or equivalent.

OCEN 652 Numerical Methods in Ocean Engineering

Credits 3. 3 Lecture Hours. Scientific computing and numerical analysis for the physical sciences and engineering; 1D and multi-D interpolation; numerical integration in 1D and multi-D including adaptive quadrature; numerical solutions of ordinary di#erential equations (ODE's) including stability analysis, numerical solutions of 1D and multi-D linear and non-linear partial di#erential equations (PDE's) covering concepts of stability and accuracy. **Prerequisite:** MATH 151, MATH 305, and MATH 308 or equivalents; coding experience in MATLAB or GNU Octave.

OCEN 660 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:** Graduate classification; approval of instructor.

OCEN 661 Analysis of Uncertainties for Ocean Engineers

Credits 3. 3 Lecture Hours. Introduction to the analysis of uncertainties due to the nature of the process involved, lack of knowledge, either because of lack of data or lack of knowledge, or lack of data commonly present in Ocean Engineering modelling and inferences; review of the most common probability models including those related the Poisson process in several dimensions as well as the analysis of extremes; combination of multiple sources of information via de Bayes theorem, statistical hypothesis testing. **Prerequisites:** Working knowledge of fundamental probability and statistics at upper undergraduate level.

OCEN 662 Probabilistic Modeling in Ocean Engineering

Credits 3. 3 Lecture Hours. Introduction to the stochastic modelling of natural phenomena such as ocean, coastal, ecological and hydrological processes wherein the probabilistic structure of the processes considered are of fundamental importance for description and understanding. **Prerequisites:** Working knowledge of fundamental probability and statistics including distribution theory, parameter estimation and correlation at the upper undergraduate level or introductory graduate level.

OCEN 665 Computational Fluid Dynamics

Credits 3. 3 Lecture Hours. Finite-difference and finite-element methods and basic numerical concepts for the solution of dispersion, propagation and equilibrium problems commonly encountered in real fluid flows, theoretical accuracy analysis techniques. **Prerequisite:** OCEN 300, OCEN 310, OCEN 362, or equivalent; knowledge of at least one programming language.

OCEN 671 Ocean Wave Mechanics

Credits 3. 3 Lecture Hours. Wave theory and applications to engineering problems; linear and non-linear theories of regular gravity waves; wave properties and transformation in shoaling water; spectral analysis of irregular waves; forecasting, hindcasting and theoretical spectra. **Prerequisite:** CVEN 311/EVEN 311 or equivalent.

OCEN 672 Coastal Engineering

Credits 3. 3 Lecture Hours. Effects of waves on coastal structures; design of seawalls breakwaters, jetties, harbors, ship channels and pipelines; intentional and accidental discharge of pollutants; diffusion and spreading; oil spill containment and collection. **Prerequisite:** OCEN 671.

OCEN 673 Nonlinear Hydrodynamic Problems in Ocean Engineering

Credits 3. 3 Lecture Hours. Nonlinear hydrodynamic problems involved with the complex offshore structures in high sea environment; nonlinear waves application of Volterra model to weakly nonlinear systems; generation of nonlinear model waves; nonlinear hydrodynamic interaction between waves and structure; dynamic analysis of nonlinear response of integrated offshore structures. **Prerequisites:** OCEN 671 and OCEN 678.

OCEN 675 Nonlinear Wave Dynamics

Credits 3. 3 Lecture Hours. Nonlinear wave-wave interactions in steep ocean waves significantly affect wave properties and long-term wave evolution; strong and weak wave interactions and their respective effects on waves are studied, using various perturbation methods; applications are shown through using Hybrid Wave Models to analyze wave measurements and predict wave loads on structures. **Prerequisite:** OCEN 671.

OCEN 676 Dynamics of Offshore Structures

Credits 3. 3 Lecture Hours. Review of concepts of linear structural dynamic analysis for time and frequency domain simulations, functional design of off-shore platforms, pipelines, floating structures and moorings; environmental loading problems; hydrodynamic phenomena including wind and current interaction, vortex shedding and wave forces; structure-fluid interaction models. **Prerequisites:** OCEN 671 or approval of the instructor.

OCEN 678 Fluid Dynamics for Ocean and Environmental Engineering

Credits 3. 3 Lecture Hours. General conservation laws; Navier-Stokes equations; steady and unsteady Bernoulli's equation; potential flow theory and basics of panel methods; laminar and turbulent boundary layer; dispersion and diffusion processes in laminar and turbulent flow; flow past a body of any shape. **Prerequisite:** CVEN 311/EVEN 311 or equivalent.

OCEN 679 Design of Integrated Ocean Systems

Credits 3. 3 Lecture Hours. Overview of interdisciplinary skills needed to solve real-world problems in the ocean environment; creation and simulation of complex, realistic models using multi-physics to significantly reduce human and material resources in the design to deploy systems cycle; discussion of the entire life cycle of an ocean system, from conceptualization, and parametric design to manufacture, deployment, maintenance, and end-of-life disposal. **Prerequisites:** Graduate classification; ENGR 102, OCEN 300, and OCEN 311; or approval of instructor.

OCEN 680 Mechanics of Ocean Engineering Structures

Credits 3. 3 Lecture Hours. Fundamental concepts of structural mechanics with applications to aerospace, marine, civil and mechanical structures; analysis of small deflections of beams, moderately large deflections of beams, columns, cables and shafts; elastic buckling of columns, thin-walled sections and plates; exact and approximate methods, energy methods, principle of virtual work, introduction to failure analysis of structures; examples from aerospace, civil, mechanical, offshore, and ship structures; collision and grounding of ships. **Prerequisites:** Graduate classification.

OCEN 681 Seminar

Credits 0-1. 0-1 Other Hours. Reports and discussion of current research and selected published technical articles.

OCEN 682 Coastal Sediment Processes

Credits 3. 3 Lecture Hours. Sediment properties and size distribution, fluvial sediment transport equations, movement of material by the sea, review of pertinent wave theories, littoral drift, inlet stability, coastal protection structures, similarity in sediment transport, movable bed models, sediment tracing, Aeolian sand transport, case studies. **Prerequisite:** OCEN 671 or approval of instructor.

OCEN 684 Professional Internship

Credits 1 to 3. 1 to 3 Other Hours. Ocean Engineering research and design experience at government or industry facilities away from the Texas A&M campus; project supervised jointly by faculty and personnel at these locations; projects selected to match student's major. May be taken three times for credit. **Prerequisites:** Graduate classification and approval of committee chair and department head.

OCEN 685 Directed Studies

Credits 1 to 12. 1 to 12 Other Hours. Special topics not within scope of thesis research and not covered by other formal courses.

OCEN 689 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours. Selected topics in an identified area of ocean engineering. May be repeated for credit.

OCEN 691 Research

Credits 1 to 23. 1 to 23 Other Hours. Research for thesis or dissertation.