• **OCE 101: Introduction to Ocean Engineering**  
  **SEM:** (1 cr.) Overview of ocean engineering topics pointing out the common areas with other engineering branches but emphasizing specific ocean applications. (Seminar)

• **OCE 205: Ocean Engineering Design Tools**  
  **LEC:** (4 crs.) An introduction to design and analysis tools for ocean engineering including computer aided design (CAD) in two- and three-dimensions, circuit layout and analysis, hydrodynamic modeling, mathematical computation, visualization, and algorithm development. (Lec. 3, Lab. 1) Pre: EGR 106 or permission of instructor.

• **OCE 206: Ocean Instrumentation and Design**  
  **LEC:** (4 crs.) Introductory lecture/lab course in ocean instrumentation covering theory, design, and implementation of basic circuits through electronic subsystems used in robotic ocean instruments and autonomous underwater vehicles (AUVs). (Lec. 3, Lab. 1) Pre: OCE 205, PHY 204 and PHY 274 (or PHY 204H, 274H), or permission of instructor.

• **OCE 301: Fundamentals of Ocean Mechanics**  
  **LEC:** (4 crs.) Mathematical methods for the analysis of ocean phenomena; Fourier analysis; partial differential equations for modeling water wave and underwater acoustics; vector calculus in wave mechanics; fundamental probability theory and applied statistics. (Lec. 3) Pre: MTH 244 and OCE 205 or permission of instructor.

• **OCE 310: Basic Ocean Measurement**  
  **LEC:** (3 crs.) Basic ocean measurement and instrumentation exercises using boats and laboratories. Includes cruise design, navigation and mapping systems, sonar systems, water quality sensors, wave spectra, computer data acquisition, and signal processing. (Lec. 1, Lab. 2) Pre: OCE 206 or permission of instructor.

• **OCE 311: Coastal Measurements And Applications**  
  **LEC:** (4 crs.) Exercises in basic coastal measurement from vessels, in situ, and in the laboratory. Experiments in measuring currents, surface elevation, wave and wave forces, geotechnical properties and applications, and acoustic propagation. (Lec. 2, Lab. 4) Pre: OCE 310, or permission of instructor.

• **OCE 313: Computational Solutions for Ocean Engineering Problems**  
  **LEC:** (3 crs.) Fundamentals of computational techniques in Ocean engineering, including algorithm development, programming, MATLAB scripts, numerical solutions of hydrodynamics, acoustics, and robotics problems, and stability and accuracy analysis. (Lec. 3) Pre: MTH 244

• **OCE 360: Robotic Ocean Instrumentation Design**  
  **LEC:** (3 crs.) Design of robotic ocean instrumentation systems featuring team–based, hands–on projects. Includes power, sensor, communication, propulsion and control system design for remotely operated and autonomous ocean instruments and underwater vehicles. (Lec. 2, Lab. 3) Pre: OCE 206 or permission of instructor.

• **OCE 408: Introduction to Engineering Wave Mechanics and Littoral Processes**  
  **LEC:** (4 crs.) Description of coastal area. Linear wave theory and applications. Sediment transport and beach dynamics. Coastal protection methods. Coastal engineering problem solving with Matlab. (Lec. 4) Pre: PHY 205, MCE 354 and OCE 301, or permission of instructor of coastal area.

• **OCE 416: Ocean Engineering Professional Practice**  
  **LEC:** (2 crs.) Introduction to professional practice in Ocean Engineering, including contemporary issues in the field, career planning and placement, life long learning strategies, professional licensure process, publication and presentation, and project management. (Lec. 2)
• **OCE 421: Marine Structure Design**  
  **LEC:** (3 crs.) Review of wave mechanics; design breaker; probability and random variables; probabilistic wave elevation height models; short-term and long-term wave statistics; probability distribution models for extreme events; selection of design waves and water levels; wave run-up and overtopping; design of rubble mound structures; design of vertical breakwaters/seawalls; wave forces on vertical piles. (Lec. 3) Pre: OCE 408 or permission of instructor.

• **OCE 422: Offshore Structure Design**  
  **LEC:** (3 crs.) Cross-listed as (OCE), CVE 422. Introduction to offshore structures, structural modeling, structural dynamic analysis, structural design for storms, structural design against fatigue failure. (Lec. 3) Pre: OCE 421. Not for graduate credit.

• **OCE 425: Coastal Experiments**  
  **LEC:** (4 crs.) Basic coastal measurement techniques for coastal management. Experimental (field and laboratory) measurements of physical and geological parameters. Major student designed, operated, and reported experiment addressing a practical problem. (Lec. 2, Lab. 4) Not for credit in ocean engineering. Pre: MTH 107 or 108 or equivalent.

• **OCE 467: Design of Remotely Operated Vehicles**  
  **LEC:** (3 crs.) This course will provide the students with the fundamental elements of remotely operated vehicle (ROV) design, and the specifics of ROV components. (Lec. 3) Pre: OCE 360 or permission of instructor.

• **OCE 471: Underwater Acoustics**  
  **LEC:** (4 crs.) Vibrations, the acoustic wave equation, duct acoustics, and sound pressure levels and spectra. Underwater acoustics including transducers, arrays, surface and bottom scattering, and ray propagation. (Lec. 3) Pre: OCE 301 and PHY 205. Not for graduate credit.

• **OCE 472: Sonar Systems Design**  
  **LEC:** (3 crs.) Fundamentals of design of sonar systems. Effects of sound propagation in deep and shallow oceans, noise, scattering on system performance. Array, transducer, and signal design. Passive and active sonar applications. (Lec. 3) Pre: 471.

• **OCE 483: Shallow Foundations**  
  **LEC:** (3 crs.) Cross-listed as (CVE), OCE 483. Applications of geotechnical engineering principles to analysis and design of shallow foundations. Foundation types, lateral earth pressures, bearing capacity, settlement, gravity retaining walls, cantilever sheet pile walls. (Lec. 3) Pre: CVE 381.

• **OCE 491: Special Problems I**  
  **IND:** (1–6 crs.) Advanced work under the supervision of a faculty member arranged to suit the individual requirements of the student. (Independent Study) Pre: permission of chairperson. Not for graduate credit.

• **OCE 492: Special Problems II**  
  **IND:** (1–6 crs.) Advanced work under the supervision of a faculty member arranged to suit the individual requirements of the student. (Independent Study) Pre: permission of chairperson. Not for graduate credit.

• **OCE 495: Ocean Systems Design Project I**  
  **LEC:** (3 crs.) Capstone design of an ocean system under the direction of a faculty advisor. Project must include engineering, economic, environmental, safety, and societal considerations. This is first of a two-course ocean engineering design sequence. Pre: senior standing and permission of instructor. Not for graduate credit.

• **OCE 496: Ocean Systems Design Project II**
LEC: (3 crs.) Capstone design of an ocean system under the direction of a faculty advisor. Project must include engineering, economic, environmental, safety, and societal considerations. This is second of a two-course ocean engineering design sequence. Pre: permission of instructor. Not for graduate credit. (D1) (B2)

- **OCE 500: Ocean Engineering Design Studies**
  
  LEC: (1–6 crs.) Off-campus ocean engineering design studies. Must include significant hands-on (laboratory or field) experience, use of engineering design tools, and the design, development, test and evaluation of hardware/software systems. Pre: Junior standing in Ocean Engineering and permission of department chair.

- **OCE 506: Numerical Models and Data Analysis in Ocean Sciences**
  
  LEC: (3 crs.) Cross-listed as (OCG), OCE 506. An introduction to numerical methods in all disciplines of oceanography and ocean engineering. Topics include model formulation, analysis, and simulation; data analysis and parameter estimation. Problem solving with Matlab and C in the weekly computer laboratory. (Lec. 2, Lab. 3)

- **OCE 510: Engineering Ocean Mechanics**
  
  LEC: (3 crs.) Fundamental equations of estuarine and coastal hydrodynamics. Scaling of governing equations. Long period waves including seiches, tides, storm surges, and tsunamis. Wind- and estuarine-induced circulation. Pollutant and sediment transport. (Lec. 3) Pre: MCE 354 or equivalent.

- **OCE 512: Ocean Waves and Storm Surge Modeling**
  
  LEC: (3 crs.) Cross-listed as (OCG), OCE 512. Wind wave generation, evolution, and dissipation. Statistical description of surface waves. Interaction between waves and currents. Wave prediction models. Observational methods of waves. Storm surge models and prediction. (Lec. 3) Pre: OCE 408 or equivalent, or permission of instructor.

- **OCE 513: Ocean Renewable Energy**
  
  LEC: (3 crs.) Cross-listed as (OCE), OCG 513. Introductory topics related to global ocean renewable energy, including fundamentals of hydrokinetic, tidal, and wave energy, leading energy devices, and more advanced topics including resource assessment and environmental interactions. (Lec. 3) Pre: MCE 354 or permission of instructor.

- **OCE 514: Engineering Wave Mechanics and Nearshore Processes**
  

- **OCE 516: Biomimetics in Ocean Engineering**
  
  LEC: (3 crs.) Biologically-inspired design mechanics in ocean engineering applications. Topics include unsteady propulsion (fish swimming), dynamic lift, high-speed maneuvering, energy extraction, drag reduction, and optimization. Pre: EGR 515 or permission of instructor. (Lec. 3)

- **OCE 522: Dynamics of Waves and Structures**
  
  LEC: (3 crs.) Deterministic analysis for SADOF structures; MDOF dynamic analysis; distributed-parameter systems; linear and second-order Stokes wave theories; wave forces on cylinders; chaotic vibration of marine structures. (Lec. 3) Pre: MCE 464 or permission of instructor.

- **OCE 534: Corrosion and Corrosion Control**
  
  LEC: (3 crs.) Cross-listed as (CHE), OCE 534. Chemical nature of metals, electrochemical nature of corrosion. Types of corrosion, influence of environment, methods of corrosion control. Behavior of
engineering materials in corrosion with emphasis on industrial and ocean environments. (Lec. 3) Pre: permission of instructor.

- **OCE 550: Ocean Systems Engineering**
  **LEC:** (3 crs.) Cross-listed as (OCE), ELE 550. Introduction to the design of systems for use in the ocean environment with emphasis on interaction of various subsystem disciplines to achieve total system performance characteristics. Introduction to detection, localization, classification and time measurement strategies including Global Positioning system, underwater Acoustics Positioning and control, wireless acoustic and electromagnetic communication, and remote time transfer. Examples will include mobile, fixed, autonomous, distributed and networked sensors. Pre: MTH 451 or equivalent.

- **OCE 555: Modern Oceanographic Imaging and Mapping Techniques**
  **LEC:** (3 crs.) Cross-listed as (OCG), OCE 555. Overview of current imaging and mapping techniques used in oceanography and ocean engineering including: photographic and laser imaging, side scan and multibeam sonar; underwater vehicle navigation and map making. (Lec. 3) Pre: undergraduates – OCE 471 or permission of instructor; graduate students – none, this is an overview course appropriate for science-focused graduate students.

- **OCE 560: Introduction to Data Collection Systems**
  **LEC:** (3 crs.) Practical problems of data collection. Probes and sensors, interfaces, signal conditioning, and storage. Examples found among the current research areas within ocean engineering will be emphasized. (Lec. 3) Pre: graduate standing in engineering or permission of instructor. In alternate years.

- **OCE 561: Introduction to the Analysis of Oceanographic Data**
  **LEC:** (3 crs.) Design of oceanic experiments to determine spatial and temporal sampling rate, precision, accuracy, signal-to-noise ratio, etc. Description of typical ocean data collection and analysis systems. Development of relevant techniques. (Lec. 3) Pre: ISE 311 (411), MTH 451, or equivalent.

- **OCE 562: Modeling, Simulation and Control of Marine Vehicles**
  **LEC:** (3 crs.) Design of control systems for surface and underwater vehicles; Development of linear and nonlinear maneuvering models; heading and sea-keeping autopilots; waypoint navigation; thruster and control surface modeling. (Lec. 3) Pre: EGR 515 or permission of instructor.

- **OCE 565: Ocean Laboratory I**
  **LEC:** (3 crs.) Measurements, experiments, operation of apparatus in the ocean and in the laboratory. Statistical theory, planning multivariable experiments, checking of data, etc. (Lec. 1, Lab. 6) Pre: graduate standing in engineering or oceanography, or permission of instructor.

- **OCE 571: Underwater Acoustics I**
  **LEC:** (3 crs.) Cross-listed as (OCE), ELE 571. Introduction to sound generation, transmission, and reception, including vibration of mechanical systems, acoustic waves in fluids, acoustic transducers and arrays, acoustic propagation in the ocean, and sonar systems. (Lec. 3)

- **OCE 572: Underwater Acoustic Transducers**
  **LEC:** (3 crs.) Theory, design, and calibration of electroacoustical transducers including dynamical analogies and equivalent circuits, piezoelectric and magnetostrictive materials, transmitting and receiving responses, reciprocity and acoustic measurements. (Lec. 3) Pre: OCE 471 or equivalent.

- **OCE 575: Marine Bioacoustics**
  **LEC:** (3 crs.) Introduction to marine mammal hearing, sound production, and the uses of sound for communication and echolocation; dolphin sonars; analysis and processing of marine mammal signals including passive tracking; the effects of noise on marine mammals. (Lec. 3) Pre: OCE 471 or permission of instructor.
• **OCE 581: Experimental Geomechanics**  
**LEC:** (3 crs.) Cross-listed as (CVE), OCE 581. Advanced methods and techniques of geotechnical testing. Behavior of granular and cohesive soils with determination of engineering properties. Interpretation, evaluation, and engineering applications of test data. Emphasis on shearing strength, consolidation, bearing capacity, earth pressures, seepage, and slope stability. (Lec. 3) Pre: CVE 381 or equivalent.

• **OCE 582: Marine Geotechnics**  
**LEC:** (3 crs.) Cross-listed as (OCE), CVE 582. Geotechnical engineering principles as applied to marine problems. Site survey and in-situ testing, soil properties, shallow foundations and deadweight anchors, piles and pile anchors, direct and drag embedment anchors, scour. (Lec. 3) Pre: CVE 381 or equivalent or OCE 311, or permission of instructor.

• **OCE 583: Deep Foundations**  
**LEC:** (3 crs.) Cross-listed as (CVE), OCE 583. Applications of soil mechanics principles to analysis and design of piles and drilled shafts under vertical and lateral loading. Static and dynamic load testing. Introduction to ground improvement technologies. (Lec. 3) Pre: CVE 381 or equivalent.

• **OCE 591: Special Problems**  
**IND:** (1–6 crs.) Advanced work under the supervision of a faculty member arranged to suit the individual requirements of the student. (Independent Study) Pre: permission of chairperson.

• **OCE 592: Special Problems**  
**IND:** (1–6 crs.) Advanced work under the supervision of a faculty member arranged to suit the individual requirements of the student. (Independent Study) Pre: permission of chairperson.

• **OCE 599: Master's Thesis Research**  
**IND:** (1–9 crs.) Number of credits is determined each semester in consultation with the major professor or program committee. (Independent Study) S/U credit.

• **OCE 605: Ocean Engineering Seminar**  
**SEM:** (1 cr.) Seminar discussions including presentation of papers based on research or literature survey. (Seminar) S/U credit.

• **OCE 606: Ocean Engineering Seminar**  
**SEM:** (1 cr.) Seminar discussions including presentation of papers based on research or literature survey. (Seminar) S/U credit.

• **OCE 661: Analysis of Oceanographic Data Systems**  
**LEC:** (3 crs.) Design of systems for deep-ocean and estuarine data collection and processing. Space–time sampling, multivariate analysis, and convergence of moments as applied to ocean data estimation and system design. Current topics in ocean data systems. (Lec. 3) Pre: OCE 560 or ELE 506 or equivalent.

• **OCE 672: Underwater Acoustics II**  
**LEC:** (3 crs.) Cross-listed as (OCE), ELE 672. Sound transmission in ocean, transducers, active signal design for range and Doppler resolution, ambient and platform noise, classical and wave vector–frequency methods of beamforming, adaptive beamforming, characteristics of targets, and active/passive sonar systems. (Lec. 3) Pre: OCE 571.

• **OCE 673: Advanced Course in Underwater Acoustic Propagation**  
**LEC:** (3 crs.) Analysis of propagation from a concentrated acoustic source in the ocean by methods such as advanced normal mode theory, numerical integration, and Fast Fourier Transforms. Applications to ocean features such as surface ducts, shadow zones, deep–sound channel, etc. (Lec. 3) Pre: OCE 571 or equivalent.
• **OCE 676: Acoustic Radiation from Underwater Vibrators**  
  **LEC:** (3 crs.) Fundamentals of acoustic radiation from submerged structures. Radiation from planar, cylindrical, and spherical surfaces. In-vacuo and in-fluid vibration of elastic bodies. Acoustic coincidence and fluid-loading effects on radiation from elastic bodies. (Lec. 3) Pre: OCE 571 or permission of instructor.

• **OCE 677: Statistical Sonar Signal Processing**  
  **LEC:** (3 crs.) Cross-listed as (ELE), OCE 677. Basic results in probability and statistics, signal processing, and underwater acoustics are applied to the design of detection, estimation, and tracking in active sonar, passive sonar, and underwater acoustic communication. (Lec. 3) Pre: MTH 451 or ELE 509, ELE 506, and ELE 571 (or OCE 571), or equivalents. ELE 510 is useful and closely related, but not required.

• **OCE 691: Special Problems**  
  **IND:** (1–6 crs.) Advanced work under supervision of a faculty member arranged to suit the individual requirements of the student. (Independent Study) Pre: permission of chairperson.

• **OCE 692: Special Problems**  
  **IND:** (1–6 crs.) Advanced work under supervision of a faculty member arranged to suit the individual requirements of the student. (Independent Study) Pre: permission of chairperson.

• **OCE 699: Doctoral Dissertation Research**  
  **IND:** (1–12 crs.) Number of credits is determined each semester in consultation with the major professor or program committee. (Independent Study) S/U credit.