

University Of California, Berkeley
Department of Mechanical Engineering

ME 165 - Ocean-Environment Mechanics [3 units]

Elective Course

Syllabus

CATALOG DESCRIPTION

Ocean environment. Physical properties and characteristics of the oceans. Global conservation laws. Surface-waves generation. Gravity-wave mechanics, kinematics, and dynamics. Design consideration of ocean vehicles and systems. Drag and propulsion. Model-testing techniques. Prediction of resistance and response in waves, both physical modeling and computer models.

COURSE PREREQUISITES

ME 106 OR Civil and Environmental Engineering 100.

TEXTBOOK(S) AND/OR OTHER REQUIRED MATERIAL

Required skills: Introductory background in Fluid Mechanics and Dynamics of Rigid-Body. Conservation principles - Mass, momentum, and energy.

Textbooks:

E. V. Lewis, Editor, Principles of Naval Architecture, Volume 2, Resistance, Propulsion, and Vibration, SNAME Publisher, 1988.

G. L. Pickard and W. J. Emery, Descriptive Physical Oceanography, Butterworth & Heimann, 1990.

Recommended References:

R. G. Dean & R. A. Dalrymple, Water Wave Mechanics for Engineers and Scientists, World Scientific Publishing, 1991.

Randall, R. E., Elements of Ocean Engineering, SNAME Publisher, 1997.

COURSE OBJECTIVES

To provide training of mechanical engineers to understand the unique characteristics of the ocean environment, local and global scale, and to provide background on engineering and design tools that are commonly used by engineers working with system and component designs of ocean, marine energy, and ship systems.

DESIRED COURSE OUTCOMES

At the end of the course, the students should understand general scientific properties that characterize the main body of the oceans; comprehend mechanisms such as Coriolis force that drive large-scale ocean currents; understand components of drags that contribute to the resistance

DESIRED COURSE OUTCOMES (Cont.)

of a marine vehicle and the associated engineering skills in model-testing that quantify the drag characteristics of a ship hull; comprehend simple harmonic surface-wave theory, with strong realization of the underlying concepts of wave kinematics, wave energy, and group velocity.

TOPICS COVERED

Physical properties of the oceans, overall characteristics, ocean circulation, atmospheric interaction; global heat balance, water balance and salt balance; wind-generated surface-waves; surface-wave dynamics, equations of motion, wave energy; random processes, random wave description, spectral description; design considerations of ocean systems; fluid-dynamic drag; unsteady forces, dimensional analysis; principles of model testing, calm-water performance; linear system theory for motion prediction; response operators; equations of motions for ocean systems; wave excitation; response analysis in frequency domain; nonlinear forces and nonlinear motion dynamics.

CLASS/LABORATORY SCHEDULE

Three hours of lectures and 1 hour of discussion section. One week of laboratory experiments totaling about ten hours of work during the week

CONTRIBUTION OF THE COURSE TO MEETING THE PROFESSIONAL COMPONENT

Students will be exposed to issues, terminology, and design practice of the sector of maritime affairs and maritime engineering of the US and the rest of the world. Mechanical Engineers often find themselves working on the design of mechanical systems that operate in the ocean environment, which include ship-board machinery, navigation & control systems, underwater robotics, and propulsion devices, to name a few.

RELATIONSHIP OF THE COURSE TO ABET PROGRAM OUTCOMES

An ability to apply knowledge of mathematics, science, and engineering An ability to design and conduct experiments, as well as to analyze and interpret data. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

ASSESSMENT OF STUDENT PROGRESS TOWARD COURSE OBJECTIVES

Six sets of homework problems with two sets involved with design issues of the topics being addressed. One laboratory report from each team of four to five students. One midterm exam and a final exam.

PERSON(S) WHO PREPARED THIS DESCRIPTION: [Ronald W. Yeung](#) October 5, 2010

ABBREVIATED TRANSCRIPT TITLE (19 SPACES MAXIMUM): Ocean Env Mech

TIE CODE: LECS

GRADING: Letter

SEMESTER OFFERED: Fall and Spring

COURSES THAT WILL RESTRICT CREDIT: None

INSTRUCTORS: Yeung

DURATION OF COURSE: 14 Weeks

EST. TOTAL NUMBER OF REQUIRED HRS OF STUDENT WORK PER WEEK: 9

IS COURSE REPEATABLE FOR CREDIT? No

CROSSLIST: None