University Of California, Berkeley
Department of Mechanical Engineering

ME 241A– Marine Hydrodynamics I (3 units)

Graduate Course

Syllabus

CATALOG DESCRIPTION

Navier-Stokes Equations. Boundary-layer theory, laminar, and turbulent. Frictional resistance. Boundary layer over water surface. Separated flow modeling. Steady and unsteady flow. Momentum theorems. Three-dimensional water-wave theory. Formulation of wave resistance of ships. Michell's solution. Wave patterns. Applications.

COURSE PREREQUISITES

Mechanical Engineering 165 recommended or graduate standing

TEXTBOOK(S) AND/OR OTHER REQUIRED MATERIAL

"Lecture Notes on Course ME241 by J.V. Wehausen, W.C. Webster, & R.W. Yeung" & Handouts

COURSE OBJECTIVES

To provide students with a sufficient introduction to each of the topics of the course so that he/she will be able to understand the background of current literature in the hydrodynamics of marine vehicles, offshore engineering, and other ocean-related activities.

DESIRED COURSE OUTCOMES

Students with ocean- and marine-related interest will develop the necessary theoretical and experimental background to keep up with existing literature and begin research on contemporary topics.

TOPICS COVERED

(1) Introduction to the theory of viscous fluids. Conservation equations and boundary conditions. Some exact solutions. Derivation of equations of the laminar boundary layer. Application to the flat plate. Approximate methods.

(2) Similarity theory of the turbulent boundary layer. Frictional resistance associated with a turbulent boundary layer.

(3) Boundary-layer flow over a free surface. Structure of velocity profile.

(4) Separated flow about non-streamline bodies. Numerical formulation and solution features. Steady and oscillatory flows about cylinders.

(5) Introduction to linearized water-wave theory. Three-dimensional wave system in a tank, time-harmonic and steady-forward motion representations. Energy theorems. Momentum theorems for resistance analysis.

(6) Exact formulation of the problem of steady motion of a ship in an inviscid fluid with a free surface. Linearization techniques. Three-dimensional sources and sinks

(7) Derivation of Michell's integral for wave resistance. Properties of ship waves. Comparison with experiment. Applications. Ships of minimum wave resistance.

CLASS/LABORATORY SCHEDULE

3 hours of lecture and 0-1 hour of discussion (variable).

CONTRIBUTION OF THE COURSE TO MEETING THE PROFESSIONAL COMPONENT

Develop students professional abilities to analyze problems of contemporary interest and develop directions or methodologies for solutions.

ASSESSMENT OF STUDENT PROGRESS TOWARD COURSE OBJECTIVES

Homework problem: (50%)
Midterm-Quiz: (15%)
Final Exam: Either 1-hour oral or 3-hour written (35%)

PERSON(S) WHO PREPARED THIS DESCRIPTION
Professor Ronald Yeung, 10/15/2015

ABBREVIATED TRANSCRIPT TITLE (19 SPACES MAXIMUM): MARINE HYDRODYN I
TIE CODE: LECT
GRADING: Letter
SEMESTER OFFERED: Fall and Spring
COURSES THAT WILL RESTRICT CREDIT: None
INSTRUCTORS: R. W. Yeung
DURATION OF COURSE: 15 Weeks
EST. TOTAL NUMBER OF REQUIRED HRS OF STUDENT WORK PER WEEK: 10 Hrs
IS COURSE REPEATABLE FOR CREDIT? No
CROSSLIST: None