University Of California, Berkeley
Department of Mechanical Engineering

ME 241B– Marine Hydrodynamics II (3 Units)

Graduate Course

Syllabus

CATALOG DESCRIPTION

Momentum analysis for bodies moving in a fluid. Added-mass theory. Matched asymptotic slender-body theory. Small bodies in a current. Theory of motion of floating bodies with and without forward speed. Radiation and diffraction potentials. Wave forces. Hydro-elasticity formulation. Ocean-wave energy. Memory effects in time domain. Second-order formulation. Impact hydrodynamics, Hydrofoil theory and lifting surface.

COURSE PREREQUISITES

260A or 241A, or CEE 200A recommended

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 renewable ocean energy.

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.

SAMPLE TOPICS COVERED

1) Momentum theorem and hydrodynamic forces acting upon a body moving in an unbounded fluid. Added masses theory. Green's distribution.

2) Slender body theory for axial and transverse flows. Inertial forces on a small body in a current.

3) Small motions with a free surface. Added-mass and damping coefficients for oscillating bodies. Diffraction of water waves and reciprocity theorems. Froude-Krylov forces and wave-exciting forces on column structures. Effects of forward motion and current.

4) Equations of motion of floating bodies and ships. Viscous damping in rolling motion. Sample hydrodynamic applications. Wave energy extraction.

5) Hydro-elastic interactions. Memory effects in time-domain. Relationship between time and frequency domain.

6) Higher-order effects, second-order wave forces. Decomposition and properties of second-order potentials.

7) Impact hydrodynamics. Short-time and large-time solutions.

8) Review of analytic functions. Two-dimensional irrotational flow. Blasius Theorem. Kutta condition and flow about wings. Joukowski profiles. Thin-wing approximations. Linarized theory of cavitational flows. Lifting-line theory of wings of finite aspect ratio. Two-dimensional planing theory.

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 problems: (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 II
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