

1. Department, course number, title  
ORE 609 Hydrodynamics of Fluid-Body Interaction

2. Designation as a Required or Elective Course  
Required Core course

3. Course Catalog Description  
OE 609 Hydrodynamics of Fluid-Body Interaction. (3) Hydrodynamics of ships, coastal and offshore structures. Wave forces by potential theory and by Morison's equation. Method of source distribution for potential flow problems. Flows with prescribed body motion, fixed and freely floating bodies.

4. Prerequisites  
Water-Wave Theories (ORE 607)  
Basic Fluid Mechanics  
Complex Variables  
Vector Calculus

5. Textbooks and/or other required material  
Lecture Notes by R.C. Ertekin

Reference books

1. Sarpkaya and Isaacson: Mechanics of Wave Forces on Offshore Structures
2. Newman: Marine Hydrodynamics
3. Currie: Fundamental Mechanics of Fluids
4. Ippen: Estuary and Coastline Hydrodynamics
5. Mei: The Applied Dynamics of Ocean Surface Waves
6. Abramowitz and Stegun: Handbook of Mathematical Functions
7. Gradshteyn and Ryzhik: Table of Integrals, Series and Products
8. Chakrabarti: Hydrodynamics of Offshore Structures
9. Mase: Continuum Mechanics

6. ABET Course Learning Outcomes

- 1) Understand the theoretical and experimental principles of fluid-body interaction problems in the oceans,
- 2) Understand the principles of viscous and ideal flow and be able to apply the principles to problem solving that involves rigid body movements in the oceans, and
- 3) Understand the diffraction, radiation and motions of floating and submerged bodies in deterministic and irregular wave

7. Topics Covered

- 1) INTRODUCTION
- 2) DIMENSIONAL ANALYSIS
- 3) VISCOUS-FLUID FLOW
- 4) IDEAL-FLUID FLOW

- 5) WATER WAVES (The purpose is for clarification of notation and to introduce perturbation expansion)
- 6) WAVE DIFFRACTION AND FORCES
- 7) FLOWS WITH PRESCRIBED BODY MOTION AND FREELY-FLOATING BODIES
- 8) IRREGULAR-SEA ANALYSIS (The purpose is to apply the force and motion transfer functions in random waves)

#### 8. Schedule

Two 1.25-hour sessions per week.

#### 9. Contribution of course to meeting the requirements of Criterion 5

##### Assessment

9 Assignments (30%)

Midterm Exam (35%)

Final Exam (35%)

##### Usage of Engineering Tools and Computers

MS Excel Spreadsheet usage for calculations used in homeworks

##### Contribution to Professional Component

Engineering science: 2 credits

Engineering design: 1 credit

#### 10. Relationship of the Course to Program Outcomes

Program Outcome 2: Basic science, mathematics, & engineering

Program Outcome 3: Ocean engineering core

Program Outcome 6: Problem formulation & solution

#### 11. Prepared by

R.C. Ertekin – April 13, 2009

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##### Course Objectives

This course is designed to give ocean engineering students a basic background for the assessment of hydrodynamic loads acting on fixed and floating bodies in regular and irregular waves.