

1. Department, Course Number, Title

ORE 707, Nonlinear Water Wave Theories

2. Designation as a Required or Elective Course

Elective

3. Course Catalog Description

Higher-order theories. Forced oscillations. Stokes theory. Nonlinear shallow-water wave equations and hydraulic jumps; effects of rotation. Internal waves. Analytical techniques necessary will be developed as course progresses. Pre: consent.

4. Prerequisites

1. Advanced Applied Mathematics
2. Linear Water Wave Theory
3. Knowledge of a high-level computer language.

5. Textbooks and/or Other Reading Material

Textbook: Notes by R.C. Ertekin

Reference books:

J.J. Stoker, Water Waves, Interscience Publishers, Inc., New York, 1957.

G.B. Whitham, Linear and Nonlinear Waves, John Wiley & Sons, New York, 1974.

6. ABET Course Learning Outcomes

(Course objectives) This course is designed to introduce graduate students into the treatment of nonlinear water waves in both deep and shallow waters.

7. Topics Covered

1. Approach of Linear and nonlinear systems.
2. Higher-order approximations to water waves.
3. Perturbation methods.
4. Stokes' theory.
5. Shallow-water waves - KdV and Boussinesq equations.
6. Nonlinear equations and hydraulic jumps.
7. Internal waves.
8. Theory of directed fluid sheets.
9. Nonlinear drift forces on offshore platforms.

8. Class/laboratory schedule

Two 1.25-hour sessions per week.

9. Contribution of Course to Meeting the Requirements of Criterion 5

Usage of Engineering Tools and Computers

Write programs to solve various nonlinear wave propagation problems in time domain on workstations and micro computers.

Laboratory Projects

1. Linear-Nonlinear response model, ship and platform motions.
2. Selected shallow-water wave problems, shoaling, run-up.
3. Potential and viscous drift forces on floating bodies.

Contribution to Professional Component

Engineering Science: 2 credits

Engineering Design: 1 credit

10. Relationship to Program Outcomes

Program Outcome 2: Basic science, mathematics, & engineering

Program Outcome 6: Problem formulation & solution

11. Prepared by and date of revision/preparation

R.C. Ertekin, 2009