

1. Department, Course Number, Title

ORE 607 Water Wave Mechanics

2. Designation as a Required or Elective Course

Core Course

3. Course Catalog Description

Governing equations in free surface flow, deterministic and probabilistic wave theories, wave transformation, wave-induced coastal currents, tides, ocean engineering operational sea state, and design wave criteria. Pre: consent.

4. Prerequisites

Differential equations
Fluid mechanics

5. Textbooks and/or other required material

None

Reference Materials:

1. Coastal Engineering Manual – Part II, US Army Corps of Engineers, 2006 (PDF version on <http://chl.erdc.usace.army.mil>).
2. Water Wave Mechanics for Engineers and Scientists, by R.G. Dean and R.A. Dalrymple, World Scientific Publishing Company, 1991.
3. Ocean Surface Waves: Their Physics and Prediction, by S.R. Massel, World Scientific Publishing Company, 1996.

6. ABET Course Learning Outcomes

The course familiarizes students with water wave mechanics for ocean structure design and the use of measured and synthesized data to define operating and design wave conditions. Specific learning outcomes include:

1. Ability to apply knowledge of mathematics and mechanics to formulate and solve water wave problems
2. Understanding kinematics, dynamics, propagation, transformation, and statistical properties of water waves.
3. Ability to apply water wave theories in engineering design.

7. Topics Covered

1. Wave Theories. Linear, Stokes second-order, first and second-order cnoidal, solitary, and stream-function wave theories.
2. Wave Transformation. Shoaling, refraction, diffraction, reflection, breaking, and runup on beaches.
3. Random Seas. Uni-directional and directional wave spectra, Rayleigh distribution, scatter diagram, normal and extremal distributions.

4. Operational and Design Criteria. Winds, wave hindcasting and forecasting, tides, hurricane waves, storm surge, wave setup, design wave conditions and water level.
5. Wave Induced Coastal Currents. Radiation stress, harbor oscillation, cross-shore and long-shore currents.

8. Schedule

Two 1.25-hour sessions per week

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

Assessment

1 assignment and 3 projects (50%)

Class participation (10%)

Final Exam (40%)

Usage of Engineering Tools and Computers

Automated Coastal Engineering System (ACES), Coastal Engineering Manual (CEM), Excel, and Matlab

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 3: Ocean engineering core

Program Outcome 5: Use of latest tools in ocean engineering

Program Outcome 6: Problem formulation & solution

11. Prepared by

K.F. Cheung, Spring 2009