No: N853600 **波浪理論** **Fall 2021**

Wave Theory

Instructor:蕭士俊 (Shih-Chun Hsiao)

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Class: Three 50 minutes lecture per week, Tue.: 09:10-12:00 (水利系館 4648 室)

Objective: The content of this course focuses on the introduction of classical water wave theory. The material includes linear wave theory, the characteristics of wave refraction and diffraction and nonlinear wave theory. The objective of this course is to improve the understanding of the principles of classical water wave theory, especially intuition and ingenuity, and to apply these principles to solve wave-related problems.

Prerequisites: Elementary fluid mechanics, engineering mathematics

Textbook:

Dean, R. G. and Dalrymple, R. A. 1991 *Water Wave Mechanics for Engineers and Scientist*, World Scientific

Reference:

1. Mei, C. C. 1989 *The applied Dynamics of Ocean Surface Waves*, World Scientific
2. Ippen, A. T. 1966 *Estuary and coastline hydrodynamics*, McGraw-Hill

Grading:

Homework 20%
Quiz 20%
Mid-term Exam 30%
Final Examination 30%

Course Outline (subject to change)

1. **Review of Hydrodynamics (3 weeks)**
   - ◆ Review of vector analyses
   - ◆ Governing equations
   - ◆ Boundary conditions for irrotational flows
2. **Small-amplitude Wave Theory (4 weeks)**
   - ◆ Simple harmonic progressive wave
   - ◆ Wave superposition
   - ◆ Wave generation

3. **Wave Refraction over an Uneven Bottom (2 weeks)**
    - Geometric ray theory
    - Refraction and shoaling over a uniform beach
4. **Wave Scattering and Diffraction (2 weeks)**
    - Wave diffraction by a thin breakwater
    - Mild-slope equation for monochromatic wave
5. **Weakly Nonlinear Waves in an Intermediate Depth (3 weeks)**
    - Stokes expansions and Stokes' 2^{nd} waves
6. **Wave Propagation in Shallow Water (3 weeks)**
    - Boussinesq-type equations
    - Modified Boussinesq-type equation for intermediate and shallow water
7. **Wave Forces (2 weeks)**
    - Potential flow approach
    - Drag and inertia forces-Morison equation