

**SIO 211A, Ocean Waves  
Winter Quarter 2022**

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Class meets T/Th from 9-10:20

Most of the class is concerned with linear wave theory as it applies to the ocean. The emphasis is on gravity waves of various types but other waves will also be discussed. We will start with the shallow water equations to develop our understanding of the wave equation for one and then multiple layers, phase and group velocity, energetics, and wave propagation/evolution through inhomogeneous media. Subsequently the same analysis tools will be applied to other waves, including surface and internal gravity waves in a fully stratified ocean, Rossby and Kelvin waves, and potentially acoustic waves.

**Textbooks:**

Homework and exams will be based only on material covered in class. Useful additional information can be found in several textbooks, which have been placed in the google drive. I'll update the daily syllabus below with relevant chapter numbers as we go along.

**Grading:**

There will be a daily quiz at the beginning of some classes, which will be graded on a pass/fail basis. You can miss up to 2 quizzes with no consequence.

There will be homework due roughly every week. Homework will loosely alternate between traditional analytical assignments and reading/analysis of relevant journal articles. You are encouraged to work in groups, but please write up your own assignment. Homework may be hand-written or typed, as you prefer.

There will be both a mid-term and final exam, format tbd.

There will be a final project at the end of the quarter. Each student will read a few papers about some type of ocean wave of their choice (I'm happy to suggest some possibilities), and give an AGU-style (10-min) presentation with slides to the class.

The final grade will be determined as follows: daily quizzes (10%), homework (25%), paper presentation (15%), mid-term (25%), final exam (25%).

## **Daily Schedule:**

1/4: Introduction, springs as simple oscillators, start to shallow water equations (SWE)

1/6: Shallow water equations continued, wave-like solutions

1/11: SWE continued, phase velocity, kinematics

1/13: SWE continued, group velocity

1/18: SWE: energetics, energy flux, reflection at walls

1/20: Reflection at boundaries continued

1/25: Surface gravity waves, the complicated version

1/27: Introduction to 2-layer SWE waves

2/1: Continued 2-layer wave solutions

2/3: Mid-term

2/8: Adding rotation to surface and internal waves - changes to dispersion relation, kinematics, propagation

2/10: Continuous stratification part I, internal waves

2/15: Continuous stratification part II: vertically propagating and vertical mode solutions

2/17: Internal waves around the world.

2/22: Geostrophy and Kelvin wave introduction

2/24: Kelvin waves and Tides

3/1: Potential vorticity, Rossby waves part I

3/3: tbd, catch up

3/8: In-class project presentations

3/10: In-class presentations

Final exam: during finals week.