

# OCP6165: OCEAN WAVES I, LINEAR (Class Number: 19016)

**FALL 2019**

## **INSTRUCTOR**

Dr. Maitane Olabarrieta

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## **OFFICE HOURS**

Drop-in hours are given below. At other times voice mail or email messages might be left. Appointments outside the office may be made when I am available. Please call me or email me for appointments.

<b>DROP-IN HOURS</b>
Thursday: 9:35-10:25

## **CLASS SCHEDULE AND LOCATION**

Schedule: Tuesday 8:30-9:20 / 9:35-10:25

Thursday 8:30-9:20

Location: WEIM 2056

## **COURSE OBJECTIVES AND GOALS**

This course will consider the mechanics of ocean waves, and in particular the linear wave theory. The main goal is to learn and review fundamentals of linear wave mechanics:

- To become familiar with the different types of waves in the ocean.
- To learn the linear or Airy wave theory.
  - Governing equations and main assumptions.
  - Solutions for progressive and standing waves.
  - Difference between shallow/ intermediate/ deep water waves.
  - Velocity and pressure fields characterizing linear waves.
  - Energy field associated with linear waves.
  - Dispersion relation.

- To understand the processes of coastal wave transformation, and the effects of these transformations on the

Students are expected to have experience using a computer to graph data and perform simple analyses and calculations, e.g. MATLAB, python.

## LECTURES OUTLINE

- I. **INTRODUCTION** (Week 1)
  - a. Oscillatory movement.
  - b. Wave characteristics.
  - c. Dimensionless parameters.
  - d. Wave regimes and theories.
  
- II. **ELEMENTARY FLUID MECHANICS** (Weeks 2 and 3)
  - a. Flux definition
  - b. Mass conservation
    - i. Continuity equation, Eulerian representation.
    - ii. Continuity equation, Lagrangian representation.
    - iii. Incompressibility.
  - c. Momentum conservation equation (Euler's equation)
    - i. Momentum equation.
    - ii. Rotation and vorticity.
    - iii. Bernoulli equation.
  - d. Irrotational flows of incompressible fluids.
  
- III. **GOVERNING EQUATIONS FOR WATER WAVES** (Weeks 4 and 5)
  - a. Differential equations.
  - b. Boundary conditions.
    - i. Kinematic boundary condition.
    - ii. Dynamic boundary condition.
    - iii. Governing equations for water waves.

Summary:

- IV. **LINEAR WAVE THEORY** (Weeks 6, 7, and 8)
  - a. Introduction
  - b. Progressive wave solution.
    - i. Laplace equation.
    - ii. Kinematic bottom boundary condition.
    - iii. Surface boundary conditions.
    - iv. Waves propagating in 3 dimensions.

Summary:

V. **LINEAR COMBINATION OF WAVES** (Weeks 9 and 10)

- a. Reflection.
- b. Short crested waves.
- c. Wave groups.
- d. Deep and shallow water approximation.
- e. Conservation of waves.
  - i. Irrotational wave field.
  - ii. Wave conservation.

Summary:

VI. **ENERGY CONSERVATION** (Week 11, 12 and 13)

- a. Energy equation.
- b. Instantaneous form of energy balance.
- c. Average energy and energy flux.
  - i. Time averaged Energy Flux.
- d. Energy Conservation for slowly modulated linear waves.
- e. Simple applications of the energy conservation equation.

Summary:

## **EVALUATION METHOD**

There will be 6 homework assignments, an oral presentation and two exams. The first exam will be the 17<sup>th</sup> of October (1 hour) and the final exam (2 hours) will be the 3<sup>th</sup> of December. Grades will be determined by performance on homework, oral presentation and participation in class, as follows:

Homework - 50%

Oral presentation - 10%

Participation in class + in-class quizzes - 10%

Exams - 30%

Frequent in-class quizzes will be done.

## **RECOMMENDED TEXTBOOKS**

The following three textbooks are recommended (not obligatory) to complement our lectures:

- Mei, C.C., 1989. The applied dynamics of Ocean Surface Waves. Advanced series in Coastal engineering. Vol. 1. World Scientific.
- Massel, S.R., 1996. Ocean surface waves: Their physics and prediction. Advanced Series in Coastal Engineering. Vol. 11. World Scientific.

- U.S. Army Corps of Engineers, 1984. Shore protection Manual Coastal Engineering Research Center, Washington, D.C.
- Basic Coastal Engineering, R.M. Sorensen, 2006 (Third Edition).

### **CLASS ATTENDANCE AND EXAM MAKE-UP**

Class attendance is a requirement. If any student is not attending class, the student needs to previously inform the teacher. It is the students' responsibility to catch up with the classes and homework assignments.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

### **ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES**

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-391-8565, [www.dso.ufl.edu/drc/](http://www.dso.ufl.edu/drc/)) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

### **INFORMATION ON CURRENT GRADING POLICIES FOR ASSIGNING GRADE POINTS**

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

### **ONLINE COURSE EVALUATION PROCESS**

Students are expected to provide feedback on the evaluation on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

### **CLASS DEMEANOR**

Appropriate classroom demeanor is expected of all students. A faculty member may remove any student from a class if the student exhibits uncivil conduct, which includes behavior that is disinterested, disengaged, disrespectful, disruptive, defiant, or disturbing. Cell phones and text messaging during class is not permitted. A student who is participating in this behavior during class will be asked to leave.

### **HONESTY POLICY**

'UF students are bound by the Honor Pledge which states, 'We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the

following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.”

The Honor Code (<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor in this calls"

#### **CONTACT INFORMATION FOR THE COUSLING AND WELLNESS CENTER**

<http://www.counseling.ufl.edu/cwc/Default.aspx>, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

#### **DIVERSITY, EQUITY AND INCLUSION**

The Herbert Wertheim College of Engineering (HWCOE) values a diverse and inclusive community. It is integral to success in every area of our college. Therefore, the College is committed to non-discrimination with respect to all areas of human differences, including but not limited to national and ethnic origin, race, age, sex, sexual orientation, gender identity and expression, beliefs and opinions, religion and faiths, culture, socio-economic background, level of physical or mental ability, and veteran’s status. This commitment applies in all areas—to students, faculty, and staff and intends to reflect the College’s belief that educational and employment decisions and access to University activities should be based on an individual’s abilities and qualifications.

The HWCOE values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. We aspire to educate students to become future leaders capable of creating diverse and inclusive work cultures wherever their careers may take them.