

## **Syllabus for OC-4211 Ocean Dynamics II (4-0)**

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### **Course Description**

Linear theory of surface, internal, inertial-internal, Rossby, coastal and equatorial trapped waves, as well as barotropic and baroclinic instabilities in the oceans.

Homework will be assigned almost every week, and will not be required to turn in. However, it is important for you to do the homework, because the problems in exams (mid-term and final) are from my lecture notes and homework. To help you with the homework, a problem-solving session will be offered.

### **Suggested Reference Book**

Gill, A.E., 1982, Atmosphere-Ocean Dynamics, Academic Press, New York.

**Course Grades:** Mid-Term: 40% Final: 60%

### **Course Contents**

#### CHAPTER I INTRODUCTION

- 1.1 Wave - An Important Form of Motion in Oceans
- 1.2 Driving Forces and Ocean Responses
- 1.3 General Features of Ocean Waves
- 1.4 Basic Types of Ocean Waves

#### Chapter 2 OSCILLATIONS IN OCEANS

- 2.1 Sources of Vibrations
- 2.2 Buoyant Oscillation
- 2.3 Inertial (Horizontal) Oscillation
- 2.4 Coastal Effect on Inertial Oscillation
- 2.5 Vorticity Oscillation

#### CHAPTER III GENERAL FEATURES OF OCEAN WAVES

- 3.1 Description of Ocean Waves

- 3.2 Wave Dispersion
- 3.3 Multi-Dimensional Waves
- 3.4 Group Velocity
- 3.5 Basic Procedure for Obtaining Wave Solutions

## CHAPTER IV BASIC EQUATIONS AND BOUNDARY CONDITIONS

- 4.1 Boussinesq Approximation
- 4.2 Boundary Conditions
- 4.3 Free Surface Condition

## CHAPTER V LINEARIZATION OF DYNAMIC SYSTEM

- 5.1 Basic Equations for Ocean Waves
- 5.2 Means and Perturbations
- 5.3 Perturbation Method

## CHAPTER IV ENERGETICS OF LINEAR WAVES

- 6.1 Two Important Forms of Energy
- 6.2 Wave Energy Transfer

## CHAPTER VII SURFACE GRAVITY WAVES

- 7.1 Assumptions
- 7.2 Basic Equations for Surface Gravity Waves
- 7.3 Wave Solutions
- 7.4 Short Wave (Deep Wave) Approximation
- 7.5 Water-Particle Motions of a Deep-Water Wave
- 7.6 Long Wave (Shallow-Water Wave)
- 7.7 Water-Particle Motions of Shallow-Waves

## CHAPTER VIII INERTIAL-INTERNAL WAVES

- 8.1 Introduction
- 8.2 Basic Equations
- 8.3 Dispersion Relation
- 8.4 Oceanic Waveguide

## CHAPTER IX COASTAL AND EQUATORIAL TRAPPED WAVES

- 9.1 Generation of Coastal Trapped Waves
- 9.2 Basic Equations for Kelvin Waves
- 9.3 Barotropic Kelvin Waves
- 9.4 Equatorial Kelvin Waves

## CHAPTER X PLANETARY ROSSBY WAVES

- 10.1 Vorticity Oscillation
- 10.2 Quasi-Geostrophic Potential Vorticity (QGPV)
- 10.3 Rossby Wave Equation
- 10.4 Barotropic Rossby Wave
- 10.5 Baroclinic (Internal) Rossby Waves

## CHAPTER XI BAROTROPIC AND BAROCLINIC INSTABILITIES

- 11.1 Unstable Waves
- 11.2 Barotropic Instability
- 11.3 Baroclinic Instability
- 11.4 Procedures for Instability Analysis
- 11.5 Eady Model
- 11.6 Charney Model