UNIVERSITY OF GOTHENBURG

DEPARTMENT OF MARINE SCIENCES

OCM210 Physical Oceanography II, 15 credits

Fysisk oceanografi II, 15 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Marine Sciences on 2019-06-13 and was last revised on 2022-10-24 to be valid from 2022-11-02, autumn semester of 2022.

Field of education: Science 100%
Department: Department of Marine Sciences

Position in the educational system

The course is part of a master's program in physical oceanography. The course can also be read as an independent course.

The course can be part of the following programme: 1) Master's Programme in Physical Oceanography (N2FOC)

Main field of studies	*Specialization*
Physical Oceanography	A1F, Second cycle, has second-cycle course/s as entry requirements
Oceanography	A1F, Second cycle, has second-cycle course/s as entry requirements

Entry requirements

A Bachelor's degree in Natural Science, Engineering or Technology including 15 credits within Physical Oceanography.

Alternatively: 120 credits in the field of Science where at least 60 credits must be in the fields of Mathematics, Physics and Meteorology and at least 15 credits within Physical Oceanography.

Learning outcomes

Upon completion of the course, the student is expected to be able to:

Knowledge and understanding

- Introduce the equations and properties of shallow-water systems and understand the process of geostrophic adjustment
- Understand and explain the characteristics of the main waves that propagate in the sea, including the sound and gravity waves, and the Kelvin, Poincare and Rossby waves
- Understand and explain how disturbances propagate in a layered or in a stratified fluid
- Understand and explain different instability mechanisms in the ocean, including the Kelvin-Helmholtz, barotropic and baroclinic instabilities
- Understand and explain the most important physical mixing processes in the ocean and their role in driving the ocean's overturning circulation

Competence and skills

- Show the ability to set up and in some cases solve the equations for typical time-varying processes in the sea
- Know how to manipulate mathematical expressions defining the properties of propagating and standing waves
- Show the ability to identify the most important dimensionless parameters for a problem and to scale and linearize a set of equations of motion
- Understand the principles for mixing processes and fluid instabilities for some idealized flow cases
- Understand and know how to manipulate simple mathematical models of the global overturning circulation

Judgement and approach

- Use fundamental principles of physics and mathematics to develop a quantitative understanding of ocean dynamics
- Apply standard simplifications and evaluate limitations that are often associated to studies of ocean processes
- Develop an ability to apply and manipulate simple theories to gain a quantitative understanding of several key processes controlling the observed ocean variability

Course content

The course is a continuation of OCM100, Physical Oceanography I. It provides an introduction to time-dependent phenomena in the sea, such as waves and instabilities at both small and large scales. A great emphasis is on the physical understanding of how

small amplitude disturbances propagate and how a rotating fluid naturally evolves toward a state of geostrophic balance, a process known as the geostrophic adjustment. The course will also give a review of how turbulent mixing takes place in the sea, describing what controls the seasonal variability of the surface mixed layer properties and what sets the stratification in the ocean's interior.

Sub-courses

1. **Gravity and Rossby waves** *(Gravitation och Rossbyvågor),* 7.5 credits
   Grading scale: Pass with Distinction (VG), Pass (G) and Fail (U)
2. **Mixing and instabilities** *(Blandning och instabilitet),* 7.5 credits
   Grading scale: Pass with Distinction (VG), Pass (G) and Fail (U)

Form of teaching

Teaching is given mainly in the form of lectures, calculation exercises and lab report.

Language of instruction: English

Assessment

- Sub-course 1, Gravity and Rossby waves, 7.5 credits: Written exam, U / G / VG
- Sub-course 2, Mixing and instabilities, 7.5 credits: Written exam and Lab Report, U / G / V

For students who have not been approved at regular examinations, additional examination opportunities are offered. The possibilities of retaking examinations are limited and decided in consultation with the course leader.

If a student who has failed twice at the same examination wishes to change the examiner before the next examination opportunity, he/she must submit a request to the department responsible for the course that should be approved if there are no special reasons on the other hand (HF 6 § 22).

In cases where a course has been discontinued or has undergone major changes, the student shall normally be guaranteed at least three examination occasions (including the ordinary examination) during a period of at least one year, but maximum two years from the last time the course was given.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).
For grades G on a sub-course 1, 55 % is required for the exam. For grades VG on a sub-course 1, 75 % is required for the exam. For grades G on a sub-course 2, 55 % is required for the exam and approved lab report. For grades VG on a sub-course 2, 75 % is required for the exam and and approved lab report.

For grade G on the entire course, all sub-courses must be approved. For grades VG on the full course, both sub-courses must have the grade VG.

Regarding the application of the ECTS scale for grades, see Rector's decision 2007-05-28, ref. G 8 1976/07 and 2011-02-28, dnr O 2009/5545.

Course evaluation

A written evaluation is done at the end of the course. In the written evaluation, the student is anonymous. The results and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.