UNIVERSITY OF GOTHENBURG

DEPARTMENT OF MARINE SCIENCES

OC4920 Observing the Ocean from Micro to Macro Scale, 15 credits

Oceanografiska mätmetoder - observationer från mikro- till makroskala, 15 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Department of Marine Sciences on 2017-09-22 and was last revised on 2018-08-29 to be valid from 2018-11-07, autumn semester of 2018.

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

Position in the educational system

The course can be taken as a freestanding course or as an elective course in a Master's Programme.

The course can be part of the following programmes: 1) Master's Programme in Physical Oceanography (N2FOC) and 2) Marine Science, Master's Programme (N2MAV)

Main field of studies	*Specialization*
Oceanography	A1N, Second cycle, has only first-cycle course/s as entry requirements
Physical Oceanography	A1N, Second cycle, has only first-cycle course/s as entry requirements

Entry requirements

120 credits in the field of Science where at least 60 credits must be in the fields of Mathematics, Physics, Physical Oceanography, Meteorology or equivalent knowledge.

Alternatively; Bachelor's Degree (180 credits) in Marine Sciences, including 15 credits within Physical Oceanography or equivalent knowledge.

Learning outcomes

The course consists of two parts: 1. Theory and 2. Practical field experiments.

On successful completion of the course the student will be able to:

Knowledge and understanding

- Understand the different scales of physical processes in the ocean that govern circulation. Perceive relevance of these processes to climate, ecosystems and/or societal impacts
- Understand the basic physical force balance in large-scale flows
- Understand the basic small-scale processes that govern vertical exchanges in the upper ocean mixed layer
- Knowledge of the various available methods for observing ocean processes, and their advantages and disadvantages in particular with regard to the scales on which processes occur

Competence and skills

- Relate taught theory to real ocean dynamics and applications
- Independently plan a field experiment with purpose to observe one particular oceanographic process
- Practical skills using ocean observing tools (ship, instruments, available platforms)
- Competence in using the various tools for data analysis available (using forms of programming language)
- Present the results of the field experiment in written and oral form

Judgement and approach

- Evaluate the scales of different ocean processes, their uncertainty and how important they are to large scale ocean circulation/processes and climate
- Formulate and solve simple oceanographic process equations using observed data
- Assess how theoretical and observed ocean processes can be observed in the 21st Century.
- Critically evaluate scientific articles and contribute to research discussions
- Evaluate observations results, apply critical thinking to results and explain their limitations

Course content

The course provides an understanding of key ocean processes that impact its motion and the scales at which they occur. The content is framed towards methods available for 21st century ocean sciences. The course will cover the importance of the different scales that processes occur in space and time, including micro-scale mixing processes and

large-scale geostrophic flows. The course will include a field work element, where students are expected to take the theoretical knowledge and design a field experiment using available access to a research ship and scientific equipment/sensors. The students will then use the collected field observations to complete tasks in analyzing and interpreting the data given the theoretical framework.

Sub-courses

1. **Theory of oceanographic processes** *(Teori, oceanografiska processer),* 7.5 higher education credits
   Grading scale: Pass with Distinction (VG), Pass (G) and Fail (U)
   Advanced theory related to processes and motions evolving from large scale horizontal gradients. The theoretical framework will cover aspects such as geostrophy and transport capacity of large-scale currents on various seabed geometries (e.g. a coast and a deep channel).

   Advanced theory related to vertical ocean processes. These include upper ocean processes (air-sea interaction, mixed layer development and theory) and forms of ocean mixing (internal wave breaking, wind induced mixing).

2. **Project work and field studies** *(Projektarbete med fältstudie),* 7.5 higher education credits
   Grading scale: Pass (G) and Fail (U)
   The students will independently plan, perform and report/evaluate a field experiment from a research vessel at sea. Horizontal and vertical processes will quantified using advanced observational techniques. Obtained data will be analysed to quantify processes, which will be presented as a report and/or presented orally.

   The lecturer(es) participation will mainly be in the form of discussion sessions and assistance with data analysis/reporting.

Form of teaching

The teaching consists of lectures, related exercises and specialised seminars, which will take place intermittently through the course. Intermittent literature group exercises will be completed and submitted or presented for assessment. The first part of the course ends with a written exam.

Project and field work consists of: Lectures in which instruments, analyses methods and optimal field experiment planning are presented. Field planning and connection to theoretical knowledge of the processes to be observed will be conducted in groups. The course includes one week of (mandatory) field work at sea. The results of the field work will be presented and examined through written report and oral presentations.

Language of instruction: English

Assessment

Part 1: Course assessment is made through written examinations, submission of exercises, and reporting of article review and report in either written or oral form, or both. To pass part 1 of the course requires approved results on the exam and approved assignments.

Part 2: Course assessment is made through active participation in the compulsory moments and approved written field work report and oral presentation and discussion.

Mandatory elements: Participation in field experiments, as well as presentation of report and article review are mandatory

If a student, who has failed the same examined component twice, wishes to change examiner before the next examination, a written application shall be sent to the department responsible for the course and shall be granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

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 from the last time the course was given.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).
For part 1, the grades are VG, G and U. For G to be achieved, G is required for the exam and over 60% of the assignments need to be completed. For VG to be achieved, VG is required for the exam and completion of all assignments.

For part 2, the grades G and U are given. To receive G, an approved report, as well as approved presentations of report and article review is required.

On the whole course, the grades are VG, G and U. For G, G is required for parts 1 and 2. For VG to be achieved on the whole course, VG is required for part 1 and G is required for part 2.

Concerning application of the ECTS grading scale please see 28/05/2007, D No. G 8 197/07 as well as 28/02/2011, D No. O 2009/05545.

Course evaluation

A written course evaluation will be done after the end of the course. The evaluation will be used to improve the course for the future. 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.

Additional information

The course includes one week of (mandatory) field work at sea.