Physical and Chemical Oceanography (WE-DBIO-12905)

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Department: Chemistry
Faculty/Subunit: Sciences
University/Institute: VUB

Course Summary

6 study credits (SP)
150 hours of study load (ST)
26 contact hours of lecture (HOC)
26 contact hours of Seminars or Practical exercises (WPO)
00 hours of Independent or External Form of Study (ZELF)

Course level and orientation

This course is taught in:

☑ 1st year ECOMAMA  ☐ 1st semester
☐ 2nd year ECOMAMA  ☒ 2nd semester

This course is:

☑ Compulsory  ☐ Optional

Course level:

☐ Introductory course
☐ Advanced course
☒ Fundamental course
☐ Specialized course
☐ Supporting course
☒ Laboratory and field training course

Competences
This course explicitly contributes to the following competences of the curriculum of Master of Ecological Marine Management:

**General**
- Developing the own learning process
- Learning to work in a team
- Searching for data sources
- Analysing and synthesising the learning material
- Presenting and transferring the acquired knowledge
- Reporting in various ways

**Domain specific**
- Gaining fundamental scientific knowledge and insight in marine sciences
- Developing laboratory skills
- Developing practical management skills
- Planning and conducting marine research in an autonomous way
- Understanding, judging and interpreting research results
- Analytical and problem-solving thinking
- Using research supporting tools (e.g. Biostatistics, GIS etc.)
- Critically evaluating and integrating multidisciplinary scientific information
- Translating scientific information into advice for sustainable marine management
- Communicating scientific findings to various kinds of audiences

**Learning targets and goals**

After finishing this course, the student should:

1. have gained insight in basic aspects of the world ocean’s functioning in terms of physical, chemical and biological aspects
2. understand the close interactions between the physico-chemical and biological processes in the oceanic and coastal ecosystems
3. be able to conduct a nutrient dynamics study in a marine ecosystem: from the determination of concentrations to the interpretation of results.

**Prerequisites**

Basic notions on chemistry (molecular weight, chemical reactions, etc.) and physics (physical forces etc.). Basic knowledge of laboratory techniques: preparation of standard solutions, use of common glassware.

**Course content**
The first chapter of this course will deal with basic principles of physical and chemical oceanography, i.e. structure and characteristics of seawater, the effect of salinity and temperature, understanding temperature-salinity diagrams and water density. The second chapter will describe the hydrostatic equation and geostrophic currents and deal with important physical processes in the oceans such as the Ekman pump and Ekman drift. The third chapter will deal with the role of various gasses in seawater (O₂ and CO₂) and the air-sea gas exchange. The forth chapter deals with \( ^{18}\text{O} \) of water as a tracer of water masses, Redfield ratio of chemical elements, respiration coefficient; Apparent Oxygen Utilization. The fifth chapter deals with the thermohaline circulation: impact on climate and biogeochemical signatures of the deep ocean. The sixth chapter is on Carbonate chemistry: factors affecting alkalinity, pH, Total CO₂ and calcium carbonate saturation in the water column.

The last part of this course will deal with nutrient dynamics in coastal environment. It will consist of an introductory course of +/- 1h followed by a practical exercise where students will analyze major nutrients from the Scheldt Estuary and perform the interpretation of their results.

**Study material**

Course notes, provided by the lecturer (either in printed form, electronic form on VUB-Pointcarre Portfoliosystem or at the ECOMAMA-secretariat): Notes consisting of the discussed overhead transparencies/PowerPoint slides and specific research papers provided by the lecturer.

Course notes by VUB-press: NA

Recommended literature (all books are available at the library of the ANCH department, VUB):


**Assessment mode**
This course consists of several parts:

Part I (F. Dehairs, Oceanography): your score will contribute to 75 % of the final score. The exam is a written exam, closed book, evaluates HOC+WPO

Part II (N. Brion, Nutrient dynamics): your score will contribute to 25 % of the final score. The score will be attributed to the written report from the practical exercise and evaluates HOC+WPO.

There is a possibility of transferring marks of either of the two parts to the next exam session/academic year.

Additional information