**II.2.5 ENVIRONMENTAL WATER CHEMISTRY**

**A. Course description**

**1. Credit points: 3 ECTS**

**2. Time commitment:**

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| --- | --- | --- | --- | --- | --- |
| Items | Lecture | Tutorial/Exercise | Practice/Assignment | Lab-work | Total |
| No. of hours | 18 | 6 |  | 6 | 30 |

**3. Prerequisites :**

General chemistry and physics as well as environmental water chemistry of B1 and B2

**4. Recommended background knowledge:**

**5. Subject description:**

This course was designed to provide a theoretical basis for determining the composition of natural water and the behavior of chemical processes used in the treatment of waters and wastewaters. It also demonstrates how the principles can be applied for understanding the chemistry of natural waters and treatment systems and provides the student with the background necessary to use the current prevailing approach to water chemistry.

**6. Objectives & Outcome**

* After this course, the successful student will be able to:
* Interpret and predict acid/base behavior, and metal-ligand complexation of natural waters and wastewaters.
* Interpret oxidation/reduction reactions and precipitation/dissolution of minerals and amorphous solids in waters, and predict equilibrium tendencies
* Solve problems in groups and present the solutions orally .
* Understand and communicate new developments in water chemistry

**7. Assessment/ Evaluation**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Component | Attendance | Exercises | Practical | Midterm | Final |
| Percentage % | 5 | 15 | 20 | 30 | 30 |

**8. Prescribed Textbook(s)**

N/A

**B. Course content & schedule:**

1. Hydrologic cycle

Properties of Water

Composition of several types of water

Chemical terms in Hydrology.

Total dissolved solids/ Hardness

2, The Carbonate System

Acid-base equilibrium

Carbon dioxide and carbonic acid-base equilibrium.

Acid-base speciation as a function of pH

Log C-pH diagram

Alkalinity and Titration Curves

3. Acid water

Acidity and Alkalinity

Acid deposition

Acid mine drainage

4. Reduction-Oxidation (Redox) Equilibria

4.1 Use of Eh as a variable

4.1.1 Use of pe as variable

4.1.2 Definition of pe and Eh by Redox pairs

4.1.3 Measurement of Eh

4.1.4 pe-pH and Eh-pH diagrams

4.1.5 System Fe-O-H2O

4.2 Redox Conditions in Natural Water

4.2.1 Photosynthesis

4.2.2 Respiration and Decay

MID-TERM 1

Complexation

5.1 Nomenclature and Definition of Terms

5.2 Complex Stability and Equilibrium Calculations

5.3 Metal Ion Hydrolysis-H2O and OH- as Ligands

5.4 Complexes with Other Inorganic Ligands 5.5 Complexes with Organic Ligands

6. Organic Compounds in Natural Water

6.1 Natural Organic Matter

6.2 Structure of Natural Organic Solute

6.2.1 Functional groups

6.2.2 Humic Substances

6.2.3 Dissolved organic carbon (DOC) in Natural Environment

6.3 Organic pollutants (e.g. PAHs and Organochlorinated compounds)

*Notes:*

*Abbreviation: Lect. (lecture), Exr. (Exercise), Prc. (Practise).*

*Exercises may include assignment, reports, student’s presentation, homework, class exercises ...for each class sessions*

*Practicals mostly refer to Lab- work or outside practice such as field trip.*

**C. References:**

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| 1.  *Water Chemistry*, Mark M. Benjamin, McGraw-Hill, 2002 |