Faculty of Health, Science and Technology
Environmental and Energy Systems

Syllabus

Environmental Chemistry for M. Sc. Students

Course Code:	EMGB18
Course Title:	Environmental Chemistry for M. Sc. Students *Miljökemi för civilingenjörer*
Credits:	7.5
Degree Level:	Undergraduate level
Progressive Specialisation:	First cycle, has less than 60 credits in first-cycle course/s as entry requirements (G1F)

Major Field of Study:
MEI (Environmental and Energy Systems)

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2018-01-31, and is valid from the Autumn semester 2018 at Karlstad University.

Prerequisites
Introductory course 7.5 ECTS cr in environmental studies, for example, Sustainable Development for Engineering, or equivalent

Learning Outcomes
Upon completion of the course, students should be able to:
- explain important concepts in chemistry such as chemical bonding and chemical equilibrium,
- describe stoichiometry and mass balance in chemical reactions and perform basic chemical calculations,
- give an account of the chemical processes of climate change, acidification, ozone conversion, and eutrophication,
- identify molecular structures typical of toxins,
- explain the effects of some common toxins on the environment and health,
- predict probable pathways in nature of emissions of environmental pollutants,
- calculate the effects of emission on various natural systems (e.g. lakes, land, atmosphere),
- analyse ethical aspects on development and the use of proven or potentially environmental pollutants,
- describe common test protocols, especially two-level factorial designs,
- use statistics to analyse the reliability of measuring results,
- use test planning and statistics in research or industrial applications,
- analyse the possibilities and limitations of science in relation to environmental chemistry issues,
- handle chemichals and equipment safely in a laboratory,
- demonstrate skills in some common measurement methods in environmental analysis.

Content
Practical exercises take the form of excursions and laboratory sessions in which students learn sampling procedures, lab safety and measurement method in environmental studies. Ethical dilemmas are analysed using methods such as cost/benefit, the precautionary principle and the polluter-pays principle.

Course content:
- Environmental chemistry as a practical tool. Correlations between different environmental problems. Using reaction rates and equilibrium constants in calculations in order to assess the significance of different reaction pathways and to calculate substance concentrations. Equilibrium between gases and liquids (Henry's law).
- Stratospheric ozone: formation and degradation, natural and created catalysts, how ozone holes are formed.
- Tropospheric ozone: photochemical smog, the interaction of nitrogen oxides, ozone, hydrocarbons and light, primary and secondary pollutions.
- Acidification: how nitrogen oxides and sulphur oxides react into acidifying substances, alkalinity, buffer systems.
- Climate change: greenhouse gases; absorption of heat radiation, the carbonate system, aerosols, GWP weighting.
- Eutrophication: phosphate chemistry, microbiological processes regarding phosphorous and nitrogen, BOD, COD.
Environmental toxins: organic toxins and toxic equivalence, heavy metals, dispersion and effects.
Experiment design: different methods to design investigations to yield useful information.
- Measurement analysis: error propagation, confidence interval, measurement data analysis, uncertainty measurement.

Reading List
See separate document.

Examination
Assessment is based on a written exam. Attendance at laboratory sessions and excursions is mandatory.
Alll students must pass a laboratory safety test before participating in laboratory sessions.

Grades
One of the grades Pass with Distinction (5), Pass with Some Distinction (4), Pass (3) or Fail (U) is awarded in the examination of the course.

Quality Assurance
Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate
A course certificate will be provided upon request.

Additional information
The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.

Students are not reimbursed for excursion costs.

EMGB18 cannot be included in the same degree programme as EMGB19, EMGA14 and EMGB15.