Course Specifications
Valid as from the academic year 2018-2019

Course size
   Credits 6.0  Study time 180 h  Contact hrs 67.5 h

Course offerings and teaching methods in academic year 2018-2019
A (year) Dutch lecture 35.0 h
  seminar: coached exercises 5.0 h
  group work 21.25 h
  excursion 5.0 h

Lecturers in academic year 2018-2019
   Lynen, Frederic  WE07 lecturer-in-charge
   De Grave, Johan  WE13 co-lecturer
   Du Prez, Filip  WE07 co-lecturer

Offered in the following programmes in 2018-2019
   Bachelor of Science in Chemistry  crdts offering
                                   6  A

Teaching languages
   Dutch

Keywords
   Chemistry, society, ethics, regulations

Position of the course
   Making students conscious of the relation chemistry and society, and conversant with
   the ethical problems related with chemistry in all its aspects. The knowledge and
   social/communicative skills of the students are developed.

Contents
   Semester I
   Introduction
   General introduction, sustainability, ecological footprint, ethics, societal impact,
   responsibilities of chemists.

   Earth
   Introduction to geology, chemical composition of the earth and mineralogy, physical
   aspects of minerals, systematic mineralogy

   Air
   Chemistry of the atmosphere, composition of air (N2, O2, CO, O3, SO2, NO2), micro
   particles in air), air pollution: composition, influence, the troposphere, nitrogen and
   carbon cycles, oxidation processes, hydrocarbons and air quality, direct sources of air
   pollution, ozone, indoor air quality.
   Ozone layer problem, positioning in atmosphere, structure, ozone and radiation,
   Chapman steady state cycle, biological influences of UV radiation, destruction of
   stratospheric ozone, Chlorine and Fluor based hydrocarbons, hole in the ozone layer,
   worldwide solution strategy, alternatives for CFC’s, novel replacements solutes.
   Chemistry of global warming, greenhouse effect, global energy equilibrium, historical
   perspective, molecular vibrations and greenhouse effect, methane and other
   greenhouse gasses, evolution toward the future, aerosols, influence on the chemistry of
   the oceans, biodiversity, solutions.

   Water
   the unique properties of water, the importance of the hydrogen bridge formation, the
   chemistry of salt and fresh water, water cycle, water consumption, water contamination,
   legislation, water purification processes, solutions towards expected fresh waters

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shortages in the future.
Acid rain and acidification of the oceans, pH of rain, SO2 and the burning of coal, nitrogen oxide contamination and link to oxidation of hydrocarbons, the nitrogen cycle, influence of deposition of acids on materials, smog and health, influence on rivers and lakes.

**Fire**
Energy from combustion: fossil fuels and electricity, thermodynamic efficiency and energy transformation, the chemistry of coal, petroleum and natural gas, calorimetry, energy conversions at molecular level, new application of old energy sources, biodiesels, bio-matter and ethanol.
Energy from the transfer electrons, batteries, galvanic cells and electrons, types, ingredients of batteries, hydride vehicles, fuel cells, hydrogen for fuel cells, photovoltaic cells, electricity from renewable sources.
Nuclear fission and energy, usage of nuclear energy, principle and conversion to electricity, types of radioactivity, past and future vision, radioactivity and health, nuclear fission and war, half-life of isotopes, nuclear waste today and tomorrow, pros and cons of nuclear energy, future perspective.

**Debate**
Debate with variable content: e.g. geoengineering, uses of CO2, CO2 recuperation, algae: myths and realities.

**Semester II**

**Life**
Organic pollutants and life: persistent organic pollutants, dioxins, furans, PCB’s, PAH’s.
Chemistry of psychoactive solutes.
Chemistry and food I: food production capacity, food and metabolism, triglycerides, essential fatty acids, diet, saccharides and alternatives, proteins, energy from food, vitamins.
The power of the micelle, saponines, detergents, soap, micelles, applications, surfactants.
Natural toxins: fyto- myco- and fyco-toxins.
Chemical analyses van from farm to fork (+ excursion): food safety, migration of toxins through packaging materials, photo-initiators in food, EU regulations, Federal institute for food Safety, FDA, biotechnological, biological and chemical monitoring.
Communication through chemical solutes, pheromones, types, typical examples, perception in insects, humans and animals, detection and identification, pheromones in agriculture.
The world of bio-macromolecules: history at UGent, Baekeland, relevance of synthetic polymers today, definition, composition, monomers, overview, green alternatives
Organic chemistry and therapeutic drug development: functional groups, aspirin, drug development today, penicillin and antibiotics, chirality, steroids, pros and cons of generic medicines, alternative medicine, bio-therapeutics.
Chemistry of the genome, plant resistance, basic scheme of the genome, the double helix and DNA, genetic coding, proteins: shape and function, genetic manipulation, chemical synthesis through genetic manipulation, ethical aspects, pro- and contra’s.
Green chemistry: principles, atom economy, design safer chemicals, renewable feedstocks, design for degradation.
Organic chemistry (excursion): Museum history of Sciences/Kekulé/Historical perspective.

**Group work**
Preparation of a public presentation of an contemporary relevant topic as a group work in the framework of the course (e.g. doping in sports, biodiesels, helium, graphenen, etc.).

**Initial competences**
none

**Final competences**
1. Students are able to critically evaluate problems related with chemistry, society and ethics, can properly formulate a personal opinion and communicate with colleagues and neophytes in chemistry.
2. The student understands the chemical background of contemporary problems in relation to chemistry and society.
3. They can also collect relevant literature data to support their opinion.
4. The student is able to report verbally and in written format about a scientific topic to an expert and to a non-expert audience.

**Conditions for credit contract**
Access to this course unit via a credit contract is determined after successful competences assessment

**Conditions for exam contract**
This course unit cannot be taken via an exam contract

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Teaching methods
Excursion, group work, lecture, seminar: coached exercises

Extra information on the teaching methods
Theory is taught through plenary lectures. Finally students have to work in small groups (4 students) on a case study, and report on it both in a written and oral way. The latter takes place in a plenary session through a didactic presentation followed by a discussion with the whole class.

Learning materials and price
A syllabus, PowerPoint presentations and notes for the practical exercises will be available (€ 10). The group works are made available during week 11 (€ 5). Additional information and supporting material will be provided via Minerva.

References

Course content-related study coaching
It is possible to ask the professor and/or academic staff questions after the lessons or by e-mail. An appointment can be made via e-mail.

Evaluation methods
end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period
Written examination, open book examination

Examination methods in case of periodic evaluation during the second examination period
Written examination, open book examination

Examination methods in case of permanent evaluation
Participation, peer assessment, report

Possibilities of retake in case of permanent evaluation
examination during the second examination period is not possible

Extra information on the examination methods

**first examination period**
semester I: written examination
semester II: written examination + open book section

**second examination period**
written examination, open book examination

**continuous evaluation**
semester 1: participation in the debate
semester 2: reports group works + public presentations

Calculation of the examination mark
Semester I: 95% written examination + continuous evaluation (5%)
Semester II: 75% written examination + 25% reports group works + public presentations
Students who are absent without any well-justified reason or who do not participate to the evaluation, do not pass the exam for this course unit.

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