centria
University of Applied Sciences

Environmental Chemistry and Technology

Autumn 2023 (For spring, scroll down!)

Component code	Component Title	ECTS
CT00AO33-3002	**Basic Chemistry**	**6**
Goal: Student can apply and and estimate the values of results of both theoretical tasks and laboratory tasks. Student knows how to use different information sources critically. Student knows basic problem solving. The student can plan and evaluate their own work in laboratories (e.g., choosing equipment). Content: Structure of the matter, phases, periodic table, character of matter and chemical bonding, stoichiometry of chemical reactions (chemical equilibrium, acid-base -, redox -, precipitation reactions), phase changes, gas laws, concentration calculations.		
CT00AO34-3002	**Organic Chemistry**	**6**
Goal: Student understands the basic principles of organic chemistry, is capable to determine the concepts, knows the structures of molecules, and the typical reactions and analysis methods and can apply what she/he has learned. Content: Empirical formula, molecular formula and structural formula, naming and categorize the compounds and, organic chemistry reaction types (esterification, substitution-, addition- elimination- and condensation), getting familiar with instrumental analytics (UV-Vis, IR)		
CT00AO38-3001	**Analytical Chemistry**	**6**
Goal: Student is capable to plan and get laboratory work done, evaluate the results and the reliability of them. Student understands the meaning of analytics in process technic. Content: Student is capable to plan and get laboratory work done, evaluate the results and the reliability of them. Student understands the meaning of analytics in process technic.		
CT00AA31-3004	**Physical Chemistry**	**6**
Goal: The student knows the gas laws, thermodynamics and thermochemistry. He can calculate reaction enthalpies and equilibria from thermodynamic data. The student knows the basics of electrical chemistry and is able to apply this information in electrolyses, corrosion prevention, coating and electrochemical measurements.		
CTK1028-3003	**Chemical Reaction Engineering**	**6**
Goal: After completing Chemical reaction engineering - course student: is able to choose suitable reaction types for a given function; can size the reactor and select control parameters for the given system; knows the factors that affect mechanism and rates of chemical reactions; is able to compile reaction rate equation based on test results; can utilize excel in reactor design calculations Content: 1. Basics of reactor design; 2. Interpretation of batch reactor data; 3. Single ideal reactors; 4. Design of sigle reactions; 5. Homogenous reactions in parallel; 6. Reactions in series; 7. Series-parallel reactions; 8. Gas phase reactions; 9. Heat of reaction		
code unknown	**Biotechnology**	**5**
Goal: Knowing the biotechnical processes that utilise micro-organisms. Understanding the similarities and differences between the techniques of biotechnology and chemistry. Microbiology, in other words micro-organisms, their growth, conditioning, gene technology. Content: Biotechnological processes such as DNA fingerprinting, gene transformation and DNA electrophoresis.		

CT00AQ36-3001	Oil Refining	5
Goal: The students knows: The importance of oil products energy source globally and in different countries; The nature and origin of crude oil; Oil refining raw materials and products; The main process units and their roles in oil refineries; Supporting processes needed; The future in oil refining Content: 1. Usage and importance of Crude Oil; 2. Characterization, history and formation of Crude Oil; History of Oil refining; Different kinds of refinery feed stocks, reserves; 3. Crude Distillation; 4. Thermal processes; 5. Fluid catalytic cracking (FCC) and Thermofor Catalytic Cracking (TCC); 6. Hydrocracking; 7. Hydrotreating; 8. Catalytic Reforming; 9. Alkylation and MTBE/TAME-production; 10.Hydrogen production and purification, Acid gas removal; 11. Sulphur recovery process, Waste water treatment, Flare system and safety; 12. Clean Fuels & The future of oil refining		
CTK1060-3004	**Process Simulation**	**5**
Goal: The objective of this class is to introduce the student to process modelling and to the use of computer programs for the simulation of chemical processes. Content: Mathematical models of chemical processes. Different types of simulation programs. Creating models of different processes using a modular simulation program and trying “what-if” improvements to the process. The use of modular simulation programs in the design and analysis of chemical processes. Aspentec Hysys is the main simulation program.		
AV00AT28-3001	**Cleaning Techniques**	**5**
Goal: After completing the course student -can explain the basics of pollution and knows the importance of sustainability -knows the possibilities of environmental technology to reduce pollution -is able to name and identify harmful emissions in soil, water and air, and is able to recognize the sources of emissions -can describe health and environmental effects of pollutants -can identify and describe the methods used in environmental technology: Pollution prevention and different abatement techniques (primary and secondary methods) -can choose the best available technology for each case -can explain the principles of green chemistry and green engineering and can apply those principles in process design -understands the circulation economy and its importance as an operating model of the future -learns to know the importance of environmental catalysis -knows principles of LCA. Content: 1. Basics of pollution; 2. Green chemistry and Circular economy; 3. LCA; 4. Environmental catalysis; 5. Air emissions and purification methods; 6. Water and waste water treatment; 7. Soil remediation; 8. Hazardous waste treatment techniques; 9. Modern landfills		
code unknown	**Laboratory Exercises in Chemical Engineering**	**5**
The student is able to apply the information learned in the advanced course of process design and development in practice, mainly in pilot scale equipment. He also learns to evaluate to a deeper level compatibility of the measured values and differences from theory. The exercises will be done in groups of 2-4 students. Each student will compile an individual report of the experiments’ results. Handling the measured values (calculation, tables, and graphical presentations) can, however, be mutual in the group. Subjects for the exercises: distillation, absorption-desorption, flooding points in columns, liquid-liquid-extraction, heat exchange, evaporation, fluidization, mixing.		
CT00AA32-3008	**Heat and Energy Techniques**	**5**
Goal: The student understands the mechanisms of heat transfer and the use of energy balances. He learns how evaporation plants and power plants work.		
CTK1036-3003	**Process Automation**	**5**
Goal: The student understands the importance and possibilities of automation in process industry. The student knows the basics of classical control theory and, with the help of the theory, is able to select, tune and analyse the process control for different processes. Content: Components used in control loops, process dynamics and process responses, transfer functions and block diagrams, frequency analysis, graphical presentations, controller tuning,		

evaluating control quality, common controls in process industry. The course gives also basic information of dynamic system simulation using computer software.
The objective of the course is to give the student basic information of measuring techniques. After completing the course the student knows the drawing symbols of instruments and abbreviations used in PI charts. The course gives the starting points to the four basic measurements in process industry (temperature, pressure, flow and level). The course also gives a short survey into the actuator types used.

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Spring 2024

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CT00AQ28-3002	**Basics of Environmental Protection**	**5**
Goal: The student knows the environmental problems and possibilities of environmental protection. The student is familiar with the central facts of ecology and natural resources. Content: Ecological systems and their functions, raw materials and energy, sustainable development, life-cycle analysis and environmental management will be discussed.		
CT00AO48-3001	**Chemical Engineering Project**	**5**
Goal: Objectives are to understand the different phases of organized project management based on complex problems in multi-field projects. The students learn to work within projects in a small team organization. Students are able to realize a small scale laboratory project as a team. Students learn to divide work load between team members, are able to report and document the progress of the work and learn co-operation skills. Content: During this course the students choose a small practical chemical engineering project topic, plan, organize and execute the project in a small project team, schedule the project and divide the work load to the project team members, study the background of the project topic (literature research), report the project (oral presentations) and evaluate the results (intermediate and final reports). The course is assessed based on the project plan, intermediate and final reports and the poster presentation of the project.		
CTK1033-3004	**Mass Transfer**	**6**
Goal: The student has knowledge about equilibrium between phases and apply the knowledge in the mass transfer processes. Content: The Gibb's phase rule and phase equilibrium drawings in one component systems and the mathematical handling of phase equilibrium of different phases of the same substance. The vapour-liquid-equilibrium (VLE) pictures of binary mixtures in both ideal and real cases and their application in simple distillation. The construction of VLE drawings. Different types of physical state drawings of binary condensed systems and their meaning. The colligative properties of liquids and their mathematical handling. The most important legalities of the solubility of gases. The utilising databases in phase equilibrium problems. The course will emphasise the following unit operations of mass transfer: distillation, absorption, liquid-liquid-extraction, dissolving solids, crystallisation, handling humid gases, drying, adsorption, ion exchange.		
CT00AO45-3002	**Mechanical Operations in Chemical Engineering**	**6**
Goal: During the course, the student acquires basic knowledge and skills in various mechanical processes and methods, which are mainly related to the processing of minerals. The aim is to be able to dimension equipment at basic level after completing the course. In the laboratory part of the course, the student learns the operation, calculation and reporting of mechanical processes. Content: The course includes theory teaching and laboratory exercises. It includes general properties of granular material, grain size and grain size distribution. Material grinding, crushing and grinding, screening, classification. Solid separation techniques, thickening, clarification, filtration, centrifugation and cyclones. The most common enrichment methods. Dust separation as well as the most common liquid mixing equipment, mixing vessel flow patterns, evaluation of mixing efficiency and time. The most common devices and their advantages and disadvantages, as well as the most important design principles.		
CT00AO37-3002	**Chemistry Project**	**4**

Goal: Student knows the basics of project control, is capable to plan and proceed project-like working, company co-work, and can apply previously learned things. The student is capable of both oral and written reporting and time management while working. Content: Learning the basics of project-type working, estimating and presenting the project results. The course is carried out together with the process industry of the area.		
CT00AO36-3002	**Applied Chemistry**	**5**
Goal: The student connects theoretical chemistry to process industry, recognizes the variety and meaning of chemical industry especially in Finland from the economical and sustainable development aspects. Content: Getting familiar with chemistry and technology, apply theoretical knowledge to industrial scale.		
CT00AO42-3002	**Industrial Economics**	**5**
Goal: The objective of the course is to give an overview of the fundaments of industrial operations, central concepts, methods and modes of working within a company. Content: Business economics; Business operating process; Business idea; Company forms; Interest groups; Company finance; Risk management; Logistics; Marketing; Finance and accounts; Revenue, costs and profit; Break-even analysis; Pricing; Working capital; Cash flow management		
CTK1059-3005	**Fuel Production Project**	**5**
The student knows the usage possibilities that alcoholic fuels or biogas have. The student is familiar with the production processes and the specialties of alcoholic fuels and biogas. The student is able to search for research data and critically read articles within the field of alcoholic fuels and biogas. Research about one alcoholic fuel or biogas that could substitute gasoline, diesel (vehicles: car, truck, cargo ship, ferry, train, machines) and aviation fuel. The regional sustainable aspect is taken in account.		
CT00AQ29-3001	**Environment and Energy**	**5**
Goal: The student knows the the impact of consumption of energy and production of energy on the environment. He understands the problems it causes and knows the possibilities to reduce the impact. Content: Energy production and energy consumption, energy resources, annealing and their effects, purifying methods, boosting methods of energy use.		
CT00AQ35-3002	**Design of water and wastewater plants**	**5**
Goal: The student knows how water plants and waste-water plants work. He is able of designing small plants by him self and larger plants as member of a group. He can compare the technology and economy of different solutions. Content: Water plants. Waste water plants. Analysis and design. Project work.		
code unknown	**Environmental Legislation and Administration**	**5**
Goal: The objective of the course is to give the student a general view of the administration and legislation of Finnish environmental protection, including different plans, permits and other ways of control. Content: The course will review the Finnish administration structure of environmental protection with its different levels (nation, area, municipal) and the distribution of tasks to different authorities. The tasks of judicial and administrative authority will also be dealt with. The ways of control on administrative level (notices, permits, supervision) will be reviewed. When reviewing the different notices and permits, the administrative practice and applications, ways of processing and ways of monitoring that are connected with the permits will be reviewed. An emphasis will be put on the flexible handling of the permits and the joint and simultaneous handling of permits. Also the petitioning systems connected with the permits will be reviewed.		

CT00AQ32-3001	Environmental Monitoring	5
Goal: The objective of the course is to give the student a general view of the administration and legislation of Finnish environmental protection, including different plans, permits and other ways of control. Content: The release of chemicals and heavy metals into the environment and their behaviour in nature. Environmental measurings. Recovery of dependable and representative samples from the environment. Chemical and physical analysation methods.		