

Autumn 2024

Component code	Component Title	ECTS
CT00AO35	Introduction to Chemistry	2
CT00AO33	Basic Chemistry (theory part)	4
CT00AO33	Basic Chemistry (laboratory part)	2
CT00AO34	Organic Chemistry (theory part)	4
CT00AO34	Organic chemistry (laboratory part)	2
CT00AQ31	Biotechnology	5
CT00AO46	Flow Dynamics and Heat Techniques	6
CT00AO47	Computer Aided Process Calculation	2
CT00AQ36	Oil Refining	5
CT00AA31	Physical Chemistry	5
KT00AJ45	Thermodynamics	5
CT00AQ33	Environmental Legislation and Administration	5
CT00AQ30	Wood Chemistry	5
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KTK1030	Laboratory Exercises in Chemical Engineering	5
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Component code	Component Title	ECTS
CT00AO43	Leadership	3
CT00AO38	Analytical Chemistry	6
CT00AO48	Chemical Engineering Project	5
CT00AQ32	Environmental Monitoring	5
CT00AQ29	Environment and Energy	5
CT00AO44	Entrepreneurship	5
CTK1033	Mass Transfer	6
CTK1036	Process Automation	5
AV00AT28	Cleaning Techniques	5
CT00AQ37	Biofuel Production	5

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Component code	Component Title	ECTS
CT00AO35	Introduction to Chemistry	2
<p>Goal: The student understands and knows how to operate safely in laboratories. The student knows basics of equation solving principles. The student is capable to recognize and name the basic laboratory equipment and is capable to use the equipment at a laboratory. The student is capable to write a laboratory report due to Centria's instructions. Student understands the construction of natural science and the meaning of continuous learning.</p> <p>Content: Principles of laboratory work, safety at the laboratories, basic calculations and calculation routines, chemistry concepts and chemical phenomena.</p>		
CT00AO33	Basic Chemistry (theory part)	4
<p>Goal: Student can apply 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).</p> <p>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.</p>		
CT00AO33	Basic Chemistry (laboratory part)	2
<p>Goal: Student can apply 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).</p> <p>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.</p>		
CT00AO34	Organic Chemistry (theory part)	4
<p>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.</p> <p>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)</p>		
CT00AO34	Organic chemistry (laboratory part)	2
<p>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.</p> <p>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)</p>		
CT00AQ31	Biotechnology	5
<p>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.</p> <p>Content: Biotechnological processes such as DNA fingerprinting, gene transformation and DNA electrophoresis.</p>		

CT00AO46	Flow Dynamics and Heat Techniques	6
<p>Goal: After completing the course, the student is familiar with the flow properties of fluids and the methods of heat transfer. The student is able to perform calculations related to fluid mechanics, dimension a centrifugal pump, adjust its operation energy-efficiently and assess the risk of cavitation. The student is able to apply mass and energy balances related to flow systems and heat transfer.</p> <p>Content: Fundamentals of fluid mechanics. Properties of fluids. Material and energy balance for flow systems. Dimensioning of pipelines and pumps and cavitation assessment. Heat transfer methods, heat exchangers and related calculations.</p>		
CT00AO47	Computer Aided Process Calculation	2
<p>Goal: The student is able to use spreadsheets in technical calculations. The student is able to create an illustrative and user friendly spreadsheet. The student is able to build a simulation model of a simple process using commercial simulation software.</p> <p>Content: Spreadsheet lay-out; Absolute and relative references; Most important graphical presentations; The use of built in functions; Conditional functions; Protecting a spreadsheet; Modelling using a simulation program</p>		
CT00AQ36	Oil Refining	5
<p>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</p> <p>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 Thermofofor 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</p>		
CT00AA31	Physical Chemistry	5
<p>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.</p>		
KT00AJ45	Thermodynamics	5
<p>Goal: After completing the course, the student knows the laws and basic concepts of thermodynamics. The student can read properties of fluids from thermodynamic tables and diagrams and solve material and energy balance equations. The student is able to define and calculate balance calculations for heating, cooling, evaporation and drying processes. The student is able to calculate the work and heat related to compression and expansion processes.</p> <p>Content: Laws of thermodynamics and calculation models. Thermodynamic systems, material and energy balance equations. Gas state equations. Thermodynamic cycles and steam power plant processes.</p>		
CT00AQ33	Environmental Legislation and Administration	5
<p>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.</p>		

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.

CT00AQ30	Wood Chemistry	5
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The structure of wood, chemistry of wood compounds, the bark of the tree and its chemistry, the chemical structure of wood and bulk, lignin, cellulose, hemicellulose, extract substances, the chemistry of cooking and bleaching, cellulose derivatives.

CTK1028	Chemical Reaction Engineering	5
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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 single reactions; 5. Homogeneous reactions in parallel; 6. Reactions in series; 7. Series-parallel reactions; 8. Gas phase reactions; 9. Heat of reaction

KTK1030	Laboratory Exercises in Chemical Engineering	5
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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.

CTK1060	Process Simulation	5
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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. Aspen Hysys is the main simulation program.

Spring 2025

Component code	Component Title	ECTS
CT00AO43	Leadership	3
<p>Goal: The objective of the course is to understand the factors that affect people's work behavior when one works as a manager or an employee, as an individual or as part of a group.</p> <p>Content: Leadership in the context of organization and management; The evolution of leadership; Dimensions of leadership; Philosophy and style of leadership; Organization design and the main schools of management thought; General theories of human motivation</p>		
CT00AO38	Analytical Chemistry	6
<p>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.</p> <p>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.</p>		
CT00AO48	Chemical Engineering Project	5
<p>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.</p> <p>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.</p>		
CT00AQ32	Environmental Monitoring	5
<p>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.</p> <p>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.</p>		
CT00AQ29	Environment and Energy	5
<p>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.</p> <p>Content: Energy production and energy consumption, energy resources, annealing and their effects, purifying methods, boosting methods of energy use.</p>		
CT00AO44	Entrepreneurship	5
<p>Goal: The objective of the course is to give an overview of entrepreneurship in terms of a Business Plan, covering the main issues of a business context; executive summary, strategy, marketing, financial planning and budgeting.</p> <p>Content: Making a complete Business Plan individually or in a group.</p>		

CTK1033	Mass Transfer	6
<p>Goal: The student has knowledge about equilibrium between phases and apply the knowledge in the mass transfer processes.</p> <p>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.</p> <p>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.</p>		
CTK1036	Process Automation	5
<p>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.</p> <p>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.</p> <p>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.</p>		
AV00AT28	Cleaning Techniques	5
<p>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.</p> <p>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</p>		
CT00AQ37	Biofuel Production	5
<p>Goal: The student knows how to define the possible raw materials and production processes. She/he can compare the usage possibilities of biofuels and are able to interpret the requirements caused by them.</p> <p>Content: Starting materials and their characterization. Production methods and products. Usage possibilities of the products.</p>		