Opasraportti

Field of Process and Environmental Engineering (2015 - 2016)

Field of Process and Environmental Engineering

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BACHELOR'S DEGREE

In the first three years of the programme, a bachelor's degree in engineering is completed. The studies in the degree are uniform for all students in the programme. The degree provides excellent and wide-range abilities and produces the potential for employment in basic-level design and operating jobs in process and environmental engineering.

The industry-branch-independent, and phenomena-based approach of this educational programme provides students with excellent abilities to apply the learned skills to areas in addition to fields of process engineering. The studies contain courses on industry-branch-independent mechanical and chemical processes occurring in the different branches of process industry, and on phenomena related to heat and mass transfer processes and the control thereof, and give students the ability to control, optimize, design and develop different processes. The learned processes are utilized in industry, environmental construction, and in water purification.

The bachelor's degree consists of subject studies in process and environmental engineering, basic studies in mathematics and science, and studies that will produce personal non-technical professional working-life skills. The studies are divided into three phases:

1. Descriptive phase : The student will be introduced to the target phenomena in process and environmental engineering and to the control thereof on a general level.

2. Analytical phase: The student's perspective will be broadened by modelling.

3. Synthetic phase: The technical design and development approach based on the analysis of phenomena and their control is emphasised during this phase of studies.

The bachelor-level studies of the programme can be divided to four entities of knowhow, to the so-called competence areas. In all these areas, the objectives mainly focus on the student's general basic level planning skills and abilities to expand his/her knowledge in the next two cycles of education (master's and doctoral studies).

The bachelor-level competence areas and their learning outcomes are the next:

1. Phenomena-based modelling and design and the competence areas leading to those: The student learns the basic principles of phenomena-based design and will be able to produce static and dynamic process models both in industrial and natural processes, as well as analyse physical, chemical, biological and geo-scientific phenomena occurring in those processes.

2. Mastery of the entities for technical activities: The student can evaluate the engineering activities as entities with the technological, economic, occupational safety and juridical factors.

3. Command of technologies, skills and methods: The student can use necessary calculating and drawing tools with needed methods and technologies.

4. Working life skills: The student masters information management and interaction skills which are needed during studying and working.

MASTER'S DEGREE

In the fourth and fifth study year of the Master of Science in technology degree program, the student will acquire abilities in challenging design, research and development tasks of the field and also a strong foundation and eligibility for further doctoral studies. After completing the master's level studies the student will be able to design and develop different processes also from the perspective of automatic control and optimization, and economic and environmental effects thereof. In addition, he/she will be familiar with safety, as well as human resources issues in engineering.

The student chooses a major (study option) line of study within, for the master's degree. The studies mainly consist of advanced -level courses in the area of the chosen study option:

The Degree Programme of Process Engineering has seven study options:

1. Automation Engineering

2. Bioproducts and Bioprocess Engineering

3. Chemical Engineering

4. Extractive Metallurgy

5. Mineral Processing

6. Industrial Energy and Environmental Engineering

7. Water and Geo Engineering

The student studies the intermediate studies and advanced studies (Study Option Module 30/60 ECTS) and elective studies (30/60 ECTS). Elective studies have to include Advanced Practical Training (3 ECTS) and they can include language studies maximum 10 ECTS.

Master's thesis shall be written as the final work in the degree (30 ECTS).

In the master's degree the student has a lot of freedom of choosing courses and his/her knowhow is built through these personal choices.

Study option of Automation Technology: A student in this option is able to apply mathematical and graphical methods to the modelling of process dynamics, and further, to use these dynamical models in the control design, fault diagnostics and the optimization of process functions. After completing the studies for automation technology, (s)he will be able to design the instrumentation as well as the system-level automation solutions required by the target process. (S)he is also able to advance his/her skills also in the other application areas of automation.

Study option of Bioproducts and Bioprocess Engineering:

1) Specialization in Bioproduct Technology will provide competence to work in the traditional wood processing industry and in the new emerging field of biorefining. The students will have an insight into the value chain of the utilization of renewable natural resources from raw materials to the finished end products. The students will gain understanding in the environmental aspects of bioproduct technologies and in the sustainable use of natural resources. After the completion of these studies the students will be a specialist in the field of biomass processing technologies and related phenomena, and will understand the raw material and processing requirements for various product applications.

2) Specialization in Bioprocess Engineering will provide competence to work in the industry where the expertises from the phenomena in industrial biotechnology, in process engineering and/or in environmental engineering are required. The students will be able to recognize the requirements set by the biochemical phenomena for the industrial processes. After completion of the studies in Bioprocess Engineering, the students will know the essential phenomena in bioprocess engineering and can apply them in different kind of bioprocesses.

Study option of Chemical Engineering: In chemical engineering study option the basic knowledge of unit operations development in chemical engineering and process design given in bachelor studies is deepened. Professional skills can be improved by complementing the minimum requirements by studies in the fields of environmental engineering, industrial engineering, work sciences or control engineering. Also, the abilities given by the study module can be complemented according to personal interests, e.g. to mechanical engineering or deepening the knowledge on technical mathematics and natural sciences.

After completing the study option on chemical engineering the student masters the raw material and energy streams of chemical subprocesses and recognizes the essential control parameters of them. The student is also able to take into account the non-idealities and simultaneous phenomena in processes and evaluate the operation of process facilities.

Study option of Extractive Metallurgy: A graduate of extractive metallurgy will be able to utilize experimental, analytical and modelling tools that are required in the research and development of pyrometallurgical processes in which iron, steel and ferroalloys are produced. Additionally, (s)he can identify how these research methods are connected to the metallurgical applications (i.e. processes, materials and environmental effects) and to the phenomena (i.e. reactions, transport phenomena, structural changes), that take place in these applications. These metallurgical skills are supported by additional knowledge and skills of e.g. process engineering, materials science and engineering, control engineering, mineral processing, industrial engineering or environmental engineering.

Study option of Mineral Processing: A student graduating as the Mineral Processing study option as his/her major, will command the economic, legislative, geological and technological principles of mining research and development, starting from mine opening, to its closure. The Mineral Processing graduate will especially know the methods used in mining engineering, ore quarrying, mineral processing, and in mine environmental engineering, as well as the environmental effects of mining, and will master the safety issues and social responsibility of mining.

For the University of Oulu students in the Mineral Processing study option it is possible to study for a double degree with the Luleå University of Technology, Sweden. For this, an exchange period at LTU is required. There is a separate student selection for the double degree. More information on the double degree is available by contacting the study counsellors.

Study option of Industrial Energy and Environmental Engineering gives the basic abilities to the environmentally benign process design based on both external and internal measures in the plant. Furthermore, Industrial energy and environmental engineering –oriented Masters have knowledge on sustainable energy production processes and energy distribution. The starting point of this study option is the process design point of view, where especially process analysis, process evaluation, environmental engineering questions as well as sustainable production and production technologies play an important role. The Master of Science specialized in Industrial energy and environmental engineering is familiarized with typical stages in process design, sources of information and methodologies. The safety and environmental awareness as well as cost-efficiency evaluation are core competencies. The Master of Science has special know-how on e.g. utilization of catalysts in environmental applications, closed cycles in production plants, environmentally friendly raw materials, production technologies and products as well as life cycle analysis.

Study option of Industrial Engineering will give the student a broad understanding of production management, manufacturing companies, supply chains and projects. A master of science in technology, specialized in this area, is familiar with the management of production processes and the safety principles of the process industry. The graduate will have perspectives on abilities in planning, evaluation and development of organization and staff, and in the management of change. In addition, the student is able to evaluate people as a part of the working environment.

Study option of Water and Geo Engineering: A Master of Science in water resources and environmental engineering knows the basic processes that govern water flow and transport of contaminants, (s)he know how to model and assess hydraulics of surface waters and groundwater and how to dimension hydraulic structures and sub-surface drainage systems. A knowledge on environmental protection and how this is included in water resources management will be attained. The education includes insight into environmental legislation and a good knowledge on the environmental impact assessment process. Students learn how to calculate and quantify impacts of water resources development and various land use activities. The education focus on understanding unit operations in water and wastewater treatment and to dimension purification plants and the knowledge on municipal and industrial solid waste management and waste minimization. Different sampling methods for air quality, water, soils and waste will be known.

The MSc knows how to assess geotechnical requirements of urban construction work and analyses results of ground surveys and knows the basis of geotechnical design. The education and research focus on northern conditions and the engineer know the impact of frost and winter on drainage plans and land-fill bottom structures.

The Master of Science that specialise in water engineering knows how to assess the role of hydrological processes using different known models and modeling methods. The students will know key processes effecting water quality and understand the role of land use activities on surface water quality. The environmental engineer will know how to model nutrient emission, retention and transport processes in lakes and rivers. The role of flood and dam safety issues is understood.

The Master of Science that specialize in urban and civil engineering knows how to assess soil structures and their geotechnical properties relevant for construction works. The student knows how to select relevant soil research methods, how to use different computer programs used in design and dimensioning. Soil contamination issues are understood and methods known for remediation and soil and water protection. The education provides national aa-sertificate required for designers of urban infrastructure works, and with some additional credits, also the AA requirements for foundation engineering works.

Tutkintorakenteet

Bachelor of Science (Tech), Process Engineering

Tutkintorakenteen tila: published

Lukuvuosi: 2015-16

Lukuvuoden alkamispäivämäärä: 01.08.2015

Basic Studies (70 op)

A431123: Basic Studies, Process Engineering, 70 op
- *Basic Studies*
  - 477011P: Introduction to Process and Environmental Engineering I, 5 op
  - 488010P: Introduction to Process and Environmental Engineering II, 5 op
  - 031010P: Calculus I, 5 op
  - 031075P: Calculus II, 5 op
  - 031076P: Differential Equations, 5 op
  - 031078P: Matrix Algebra, 5 op
  - 031021P: Probability and Mathematical Statistics, 5 op
  - 761111P: Basic mechanics, 5 op
    - *Compulsory*
      - 761111P-01: Basic mechanics, lectures and exam, 0 op
      - 761111P-02: Basic mechanics, lab. exercises, 0 op
  - 761113P: Electricity and magnetism, 5 op
    - *Compulsory*
      - 761113P-01: Electricity and magnetism, lectures and exam, 0 op
      - 761113P-02: Electricity and magnetism, lab. exercises, 0 op
  - 780117P: General and Inorganic Chemistry A, 5 op
  - 780116P: Introduction to Organic Chemistry, 5 op
  - 780123P: Introductory Laboratory Works in Chemistry, 5 op
  - 477000P: Planning of Studies and Career, 1 op
  - 030005P: Information Skills, 1 op
  - 902011P: Technical English 3, 6 op
  - 901008P: Second Official Language (Swedish), 2 op

Intermediate Studies (60 op)

A431125: Intermediate Studies, Process Engineering, 60 op
- *Intermediate studies*
  - 477121A: Particle Technology, 5 op
  - 477122A: Bulk Solids Handling, 5 op
  - 488309A: Biocatalysis, 5 op
  - 488052A: Introduction to Bioproduct and Bioprocess engineering, 5 op
  - 477401A: Thermodynamic Equilibria, 5 op

477201A: Material and Energy Balances, 5 op
477222A: Reactor Analysis, 5 op
477052A: Fluid Mechanics, 5 op
477322A: Heat and Mass Transfer, 5 op
477304A: Separation Processes, 5 op
477203A: Process Design, 5 op
477402A: Solid Inorganic Materials, 5 op

Automation Technology (25 op)

A431126: Automation Technology, 25 op
Automation technology
477051A: Automation Engineering, 5 op
477501A: Process dynamics, 5 op
477502A: Experiment design and analysis, 5 op
477621A: Control System Analysis, 5 op
477622A: Control System Design, 5 op

Working Life Studies (25 op)

A431124: Working Life Studies, Process Engineering, 25 op
Working life studies
555225P: Basics of industrial engineering and management, 5 op
555265P: Occupational Safety and Health Management, 5 op
477004A: Practical Training, 5 op
900060A: Technical Communication, 2 op
477990A: Bachelor's Thesis / Process Engineering, 8 op

Master of Science (Tech), Process Engineering

Tutkintorakenteen tila: published

Lukuvuosi: 2015-16

Lukuvuoden alkamispäivämäärä: 01.08.2015

Supplementary Studies, Process Engineering (10 - 60 op)

Choose these supplementary studies if you have not taken Bachelor's degree at the Department of Prodcess and Environmental Engineering, and if so called 'Bridge studies' (max 60 ECTS) have been planned for you. If you are unsure on which courses to choose, contact Student Adviser.

H430495: Supplementary Studies, Process Engineering, 10 - 60 op

Modules of the Options (60 op)

Choose one Module of the Options to you PSP according to the study option you have selected.

Automation Engineering, Module of the option

A431229: Module of the Option/Automation Engineering, 61 op
Automation technology
477523S: Simulation, 5 op
477524S: Process Optimization, 5 op
477623S: Process Information Systems, 10 op
477624S: Control System Methods, 5 op
477607S: Advanced Control and Systems Engineering, 5 op

477525S: Computational intelligence in automation, 5 op

Choose 5 courses

031080A: Signal Analysis, 5 op
477506S: Modelling and Control of Biotechnical Processes, 5 op
477507S: Automation in Pulp and Paper Industry, 5 op
477508S: Automation in Metallurgical Industry, 5 op
477625S: Power Plant Automation, 5 op
477713S: Automation in Mineral Processing, 5 op

Module of the Option, Bioproducts and Bioprocess Engineering

H431230: Module of the Option/Bioproducts and Bioprocess Engineering, 60 op

Alternative

A431230: Module of the Option/Bioproducts and Bioprocess Engineering, Bioproducts Technology, 31 op

Compulsory

477123S: Chemical processing of biomasses, 5 op
477124S: Mechanical processing of biomasses, 5 op
477125S: Recycling of bioproducts, 5 op
477126S: Manufacturing of fibre products, 5 op
477127S: Research training of bioproduct technology, 10 op

A431231: Module of the Option/Bioproducts and Bioprocess Engineering, Bioprocess Engineering, 59 op

Compolsory: Prerequisites for this module are following courses: 488301A Mikrobiologia (5 ECTS), and 488302A Basics of bBiotechnology (5 ECTS).

488321S: Bioreactor technology, 5 op
488305S: Advanced Course for Biotechnology, 5 op
488311S: Industrial Microbiology, 5 op
488322S: Bioprocess Engineering, 5 op
740148P: Biomolecules, 5 op
740149P: Metabolism I, 4 op
477506S: Modelling and Control of Biotechnical Processes, 5 op
477204S: Chemical Engineering Thermodynamics, 5 op
477308S: Multicomponent Mass Transfer, 5 op
477306S: Non-ideal Reactors, 5 op
477224S: Biorefineries, 5 op
477223S: Advanced Process Design, 5 op

Module of the Option, Chemical Engineering

A431232: Module of The Option/Chemical Engineering, 58 op

Compulsory

477306S: Non-ideal Reactors, 5 op
477309S: Process and Environmental Catalysis, 5 op
477310S: Advanced Catalytic Processes, 5 op
477311S: Advanced Separation Processes, 5 op
477308S: Multicomponent Mass Transfer, 5 op
477305S: Flow Dynamics, 5 op
477204S: Chemical Engineering Thermodynamics, 5 op
477209S: Chemical Process Simulation, 5 op
477524S: Process Optimization, 5 op
477223S: Advanced Process Design, 5 op
477224S: Biorefineries, 5 op
477207S: Industrial Water and Wastewater Technologies, 5 op

Module of the Option, Extractive Metallurgy

H431231: Module of the Option/Extractive Metallurgy, 60 op

Compulsory

A431233: Module of the Option/Extractive Metallurgy, 30 op

Compulsory

477412S: Phenomena-based modelling in extractive metallurgy, 10 op
477413S: Experimental Research in Extractive Metallurgy, 10 op
477414S: Process Simulation in Extractive Metallurgy, 10 op

Module of the Option/Mineral Processing

A431234: Module of the Option/Mineral Processing, 60 op
Compulsory
477710A: Basic Course in Geology, 5 op
477704A: Principles of Mineral Processing, 5 op
477716A: Surface Chemistry Principles and Applications in Mineral and Mining Technology, 5 op
477711S: Rock and Mining Engineering, 5 op
477712S: Phenomena in Mineral Processing, 5 op
477713S: Automation in Mineral Processing, 5 op
488115A: Geomechanics, 5 op
477207S: Industrial Water and Wastewater Technologies, 5 op
488221S: Environmental Load of Industry, 5 op
488203S: Industrial Ecology, 5 op
488133A: Environmental Impact Assessment, 5 op
477715S: Environmental and Social Responsibility in Mining, 5 op

Module of the Option, Industrial Energy and Environmental Engineering

A431235: Module of the Option/Industrial Energy and Environmental Engineering, 60 op
Compulsory
477223S: Advanced Process Design, 5 op
477224S: Biorefineries, 5 op
477309S: Process and Environmental Catalysis, 5 op
488133A: Environmental Impact Assessment, 5 op
488104A: Industrial and municipal waste management, 5 op
488110S: Water and Wastewater Treatment, 5 op
488202S: Production and Use of Energy, 5 op
488203S: Industrial Ecology, 5 op
488204S: Air Pollution Control Engineering, 5 op
488221S: Environmental Load of Industry, 5 op
488206S: Sustainable Energy Project, 5 op
477307S: Research Methodology, 5 op

Module of the Option, Industrial Engineering

A431236: Module of the Option/Industrial Engineering, 60 op
Compolsory
555286A: Process and quality management, 5 op
555390S: Statistical Process Management, 5 op
555389S: Systematic Process Improvement, 10 op
Choose 2 courses
555285A: Project management, 5 op
555242A: Product development, 5 op
555226A: Operations and Production, 5 op

Module of the Option, Water and Geo Engineering

A431237: Module of the Option/Water and Geo Engineering, 60 op
Compulsory, choose also 17 ECTS from one of the electives
488133A: Environmental Impact Assessment, 5 op
488110S: Water and Wastewater Treatment, 5 op
488108S: Groundwater Engineering, 5 op
488127S: Field measurements, site investigations and geotechnical tests, 5 op
488128S: Laboratory tests in water resources engineering, 5 op
488121S: Fundamentals of Civil Engineering, 5 op
488105A: Water Supply Networks, 5 op
488117S: Water Resources Management, 5 - 7,5 op
Water Engineering
488122S: Statistical Methods in Hydrology, 5 op
488124S: Advanced Course in Hydrology, 5 op
488113S: Basics of surface water quality modelling, 5 op
488123S: River Engineering and Hydraulic Structures, 5 op

488131S: Geoenvironmental Engineering, 5 op

Geo Engineering; you may also choose 488131S Geoenvironmental Engineering and 488123S River Engineering and Hydraulic Structures

488111S: Modelling in Geoenvironmental Engineering, 5 op
460163S: Foundation Engineering, 5 op
488132S: Cold Climate Engineering, 5 op

Supplementary Module (30 op)

Course 477002S Practical Training, 3 ECTS is compulsory. All other courses student can choose free.

477005S: Advanced Practical Training, 5 op

Supplementary Module, Material Engineering

A431252: Supplementary Module, Material Engineering, 29,5 op

Free choice courses

Master's Thesis (30 op)

Choose Master's Thesis 30 ECTS.

470313S: Maturity Test / Process Engineering, 0 op

Bachelor of Science (Tech), Environmental Engineering

Tutkintorakenteen tila: published

Lukuvuosi: 2015-16

Lukuvuoden alkamispäivämäärä: 01.08.2015

Basic Studies (70 op)

A432123: Basic Studies, Environmental Engineering, 70 op

Basic Studies

477011P: Introduction to Process and Environmental Engineering I, 5 op
488010P: Introduction to Process and Environmental Engineering II, 5 op
031010P: Calculus I, 5 op
031075P: Calculus II, 5 op
031076P: Differential Equations, 5 op
031078P: Matrix Algebra, 5 op
031021P: Probability and Mathematical Statistics, 5 op
761111P: Basic mechanics, 5 op

Compulsory

761111P-01: Basic mechanics, lectures and exam, 0 op
761111P-02: Basic mechanics, lab. exercises, 0 op

761113P: Electricity and magnetism, 5 op

Compulsory

761113P-01: Electricity and magnetism, lectures and exam, 0 op
761113P-02: Electricity and magnetism, lab. exercises, 0 op

780117P: General and Inorganic Chemistry A, 5 op
780116P: Introduction to Organic Chemistry, 5 op
780123P: Introductory Laboratory Works in Chemistry, 5 op
477000P: Planning of Studies and Career, 1 op
030005P: Information Skills, 1 op

902011P: Technical English 3, 6 op
901008P: Second Official Language (Swedish), 2 op

Intermediate Studies (60 op)

A432125: Intermediate Studies, Environmental Engineering, 60 op
Intermediate Studies
488104A: Industrial and municipal waste management, 5 op
488201A: Environmental Ecology, 5 op
477401A: Thermodynamic Equilibria, 5 op
477201A: Material and Energy Balances, 5 op
477222A: Reactor Analysis, 5 op
477052A: Fluid Mechanics, 5 op
477322A: Heat and Mass Transfer, 5 op
477304A: Separation Processes, 5 op
477121A: Particle Technology, 5 op
477122A: Bulk Solids Handling, 5 op
488051A: AutoCAD and Matlab in Process and Environmental Engineering, 5 op
477051A: Automation Engineering, 5 op

Environmental Engineering (25 op)

Choose one module (25 ECTS).

Water and Geotechnics

A432126: Environmental Engineering, Water and Geotechnics, 25 op
Water and geotechnics
488012A: Environmental Legislation, 5 op
488102A: Hydrological Processes, 5 op
488119A: Basics of infrastructure planning and development, 5 op
488115A: Geomechanics, 5 op
477502A: Experiment design and analysis, 5 op

Environmental Engineering

A432127: Environmental Engineering, 25 op
Environmental Engineering
488012A: Environmental Legislation, 5 op
488309A: Biocatalysis, 5 op
488052A: Introduction to Bioproduct and Bioprocess engineering, 5 op
477502A: Experiment design and analysis, 5 op
477203A: Process Design, 5 op

Working Life Studies (25 op)

A432124: Working Life Studies, Environmental Engineering, 25 op
Working Life Studies
555225P: Basics of industrial engineering and management, 5 op
555265P: Occupational Safety and Health Management, 5 op
477004A: Practical Training, 5 op
900060A: Technical Communication, 2 op
488990A: Bachelor's Thesis / Enviromental Engineering, 8 op

Master's Degree Programme (BCBU) in Environmental Engineering (BEE)

Tutkintorakenteen tila: published

Lukuvuosi: 2015-16

Lukuvuoden alkamispäivämäärä: 01.08.2015

Clean Production Study Option (120 op)

BEE/Clean Production Basic and Advanced Modules must add up in total **90 cr.** All courses in the **Basic Module** (30 cr) of the CP study option are compulsory. The **Advanced Module** (60 cr) contains both compulsory and optional studies.

Basic Module of Clean Production 30 ECTS

A432225: Module of Option / Basic Module of Clean production, 28 - 31 op

Compulsory

- 030008P: Information Skills for foreign degree students, 1 op
- 900017Y: Survival Finnish Course, 2 op
- 900013Y: Beginners' Finnish Course 1, 3 op
- 488400A: Orientation to the BEE studies, 0 - 1 op
- 477005S: Advanced Practical Training, 5 op
- 488401A: Introduction to the Barents Region, 2 op
- 488402A: Sustainable Development, 3 op
- 477307S: Research Methodology, 5 op
- 477041S: Experimental Design, 5 op
- 477203A: Process Design, 5 op

Advanced Module of Clean Production 60 ECTS

A432275: Advanced Module/Clean Production, 30 - 62 op

Compulsory

- 488203S: Industrial Ecology, 5 op
- 488202S: Production and Use of Energy, 5 op
- 477309S: Process and Environmental Catalysis, 5 op
- 488221S: Environmental Load of Industry, 5 op
- 488204S: Air Pollution Control Engineering, 5 op
- 488104A: Industrial and municipal waste management, 5 op

Optional; choose 30 ECTS

- 488201A: Environmental Ecology, 5 op
- 477523S: Simulation, 5 op
- 477209S: Chemical Process Simulation, 5 op
- 477306S: Non-ideal Reactors, 5 op
- 477223S: Advanced Process Design, 5 op
- 477305S: Flow Dynamics, 5 op
- 477311S: Advanced Separation Processes, 5 op
- 477310S: Advanced Catalytic Processes, 5 op
- 488206S: Sustainable Energy Project, 5 op

Water and Environment Study Option (120 op)

BEE/Water and Environment Basic and Advanced Modules must add up in total **90 cr.** All courses in the **Basic Module** (30 cr) of the WE study option are compulsory. The **Advanced Module** (60 cr) also contains only compulsory studies.

Basic Module of Water and Environment 30 ECTS

A432226: Module of Option/Basic Module of Water and Environment, 30 op

Compulsory

- 030008P: Information Skills for foreign degree students, 1 op
- 900017Y: Survival Finnish Course, 2 op
- 900013Y: Beginners' Finnish Course 1, 3 op
- 488400A: Orientation to the BEE studies, 0 - 1 op
- 477005S: Advanced Practical Training, 5 op

488401A: Introduction to the Barents Region, 2 op
488402A: Sustainable Development, 3 op
477307S: Research Methodology, 5 op
477041S: Experimental Design, 5 op
477203A: Process Design, 5 op

Advanced Module of Water and Environment 60 ECTS

A432276: Advanced Module/Water and Environment, 60 op
Compulsory
488102A: Hydrological Processes, 5 op
488108S: Groundwater Engineering, 5 op
488110S: Water and Wastewater Treatment, 5 op
488127S: Field measurements, site investigations and geotechnical tests, 5 op
488128S: Laboratory tests in water resources engineering, 5 op
488117S: Water Resources Management, 5 - 7,5 op
488104A: Industrial and municipal waste management, 5 op
488133A: Environmental Impact Assessment, 5 op
488113S: Basics of surface water quality modelling, 5 op
488122S: Statistical Methods in Hydrology, 5 op
488123S: River Engineering and Hydraulic Structures, 5 op
488124S: Advanced Course in Hydrology, 5 op

Master's Thesis and written Maturity Test (30 op)

Choose the Master's Thesis (compulsory 30 ECTS) of your own study option:

488997S Master's Thesis/ Master's Degree Programme (BCBU) in Environmental Engineering, Clean Production, or

488998S Master's Thesis/ Master's Degree Programme (BCBU) in Environmental Engineering, Water and Environment.

In addition, a written Maturity Test is compulsory in this Module.

480429S: Maturity Test / Environmental Engineering, 0 op

Master's degree Programme of Environmental Engineering

Tutkintorakenteen tila: published

Lukuvuosi: 2015-16

Lukuvuoden alkamispäivämäärä: 01.08.2015

Supplementary Studies, Environmental Engineering (10 - 60 op)

Choose these supplementary studies if you have not taken Bachelor's degree at the Department of Prodcess and Environmental Engineering, and if so called 'Bridge studies' (max 60 ECTS) have been planned for you. If you are unsure which courses to choose, contact Student Adviser.

H431595: Supplementary Studies, Environmental Engineering, 10 - 60 op
Bridge Studies
031010P: Calculus I, 5 op
031021P: Probability and Mathematical Statistics, 5 op
031022P: Numerical Analysis, 5 op
477011P: Introduction to Process and Environmental Engineering I, 5 op
477201A: Material and Energy Balances, 5 op
477203A: Process Design, 5 op
477304A: Separation Processes, 5 op

477401A: Thermodynamic Equilibria, 5 op
477501A: Process dynamics, 5 op
477502A: Experiment design and analysis, 5 op
488010P: Introduction to Process and Environmental Engineering II, 5 op
488102A: Hydrological Processes, 5 op
031076P: Differential Equations, 5 op
031075P: Calculus II, 5 op
031078P: Matrix Algebra, 5 op
477121A: Particle Technology, 5 op
477122A: Bulk Solids Handling, 5 op
477222A: Reactor Analysis, 5 op
477052A: Fluid Mechanics, 5 op
477322A: Heat and Mass Transfer, 5 op
477051A: Automation Engineering, 5 op
477621A: Control System Analysis, 5 op
477622A: Control System Design, 5 op

Modules of the Options (60 op)

Choose one Module of the Options to you PSP according to the study option you have selected.

Automation Engineering, Module of the option

A432227: Module of the Option/Automation Engineering, 61 op
E1
477523S: Simulation, 5 op
477524S: Process Optimization, 5 op
477623S: Process Information Systems, 10 op
477607S: Advanced Control and Systems Engineering, 5 op
477525S: Computational intelligence in automation, 5 op
Choose 5 courses
031080A: Signal Analysis, 5 op
477506S: Modelling and Control of Biotechnical Processes, 5 op
477507S: Automation in Pulp and Paper Industry, 5 op
477508S: Automation in Metallurgical Industry, 5 op
477625S: Power Plant Automation, 5 op
477713S: Automation in Mineral Processing, 5 op

Module of the Option, Bioproducts and Bioprocess Engineering

H432228: Module of the Option/Bioproducts and Bioprocess Engineering, 60 op
Optional
A432228: Module of the Option/Bioproducts and Bioprocess Engineering, Bioproduct Tehcnology, 31 op
Compulsory
477123S: Chemical processing of biomasses, 5 op
477124S: Mechanical processing of biomasses, 5 op
477125S: Recycling of bioproducts, 5 op
477126S: Manufacturing of fibre products, 5 op
477127S: Research training of bioproduct technology, 10 op
A432229: Module of the Option/Bioproducts and Bioprocess Engineering, Bioprocess Engineering, 59 op
Compulsory
488321S: Bioreactor technology, 5 op
488305S: Advanced Course for Biotechnology, 5 op
488311S: Industrial Microbiology, 5 op
488322S: Bioprocess Engineering, 5 op
740148P: Biomolecules, 5 op
740149P: Metabolism I, 4 op
477506S: Modelling and Control of Biotechnical Processes, 5 op
477204S: Chemical Engineering Thermodynamics, 5 op
477308S: Multicomponent Mass Transfer, 5 op
477306S: Non-ideal Reactors, 5 op
477224S: Biorefineries, 5 op

477223S: Advanced Process Design, 5 op

Module of the Option, Chemical Engineering

A432230: Module of the Option/Chemical Engineering, 58 op

Compulsory

477306S: Non-ideal Reactors, 5 op
477309S: Process and Environmental Catalysis, 5 op
477310S: Advanced Catalytic Processes, 5 op
477311S: Advanced Separation Processes, 5 op
477308S: Multicomponent Mass Transfer, 5 op
477305S: Flow Dynamics, 5 op
477204S: Chemical Engineering Thermodynamics, 5 op
477209S: Chemical Process Simulation, 5 op
477524S: Process Optimization, 5 op
477223S: Advanced Process Design, 5 op
477224S: Biorefineries, 5 op
477207S: Industrial Water and Wastewater Technologies, 5 op

Module of the Option, Extractive metallurgy

H432229: Module of the Option/Extractive Metallurgy, 60 op

Compulsory

A432231: Module of the Option/Extractive Metallurgy, 30 op

Compulsory

477412S: Phenomena-based modelling in extractive metallurgy, 10 op
477413S: Experimental Research in Extractive Metallurgy, 10 op
477414S: Process Simulation in Extractive Metallurgy, 10 op

Module of the Option/Mineral Processing

A432232: Module of the Option/Mineral Processing, 60 op

Compulsory

477710A: Basic Course in Geology, 5 op
477704A: Principles of Mineral Processing, 5 op
477716A: Surface Chemistry Principles and Applications in Mineral and Mining Technology, 5 op
477711S: Rock and Mining Engineering, 5 op
477712S: Phenomena in Mineral Processing, 5 op
477713S: Automation in Mineral Processing, 5 op
488115A: Geomechanics, 5 op
477207S: Industrial Water and Wastewater Technologies, 5 op
488221S: Environmental Load of Industry, 5 op
488203S: Industrial Ecology, 5 op
488133A: Environmental Impact Assessment, 5 op
477715S: Environmental and Social Responsibility in Mining, 5 op

Module of the Option, Industrial Energy and Environmental Engineering

A432233: Module of the Option/Industrial Energy and Environmental Engineering, 60 op

Compulsory

477223S: Advanced Process Design, 5 op
477224S: Biorefineries, 5 op
477309S: Process and Environmental Catalysis, 5 op
488133A: Environmental Impact Assessment, 5 op
488104A: Industrial and municipal waste management, 5 op
488110S: Water and Wastewater Treatment, 5 op
488202S: Production and Use of Energy, 5 op
488203S: Industrial Ecology, 5 op
488204S: Air Pollution Control Engineering, 5 op
488221S: Environmental Load of Industry, 5 op
488206S: Sustainable Energy Project, 5 op
477307S: Research Methodology, 5 op

Module of the Option, Industrial Engineering

A432234: Module of the Option/Industrial Engineering, 60 op
Compulsory
555286A: Process and quality management, 5 op
555390S: Statistical Process Management, 5 op
555389S: Systematic Process Improvement, 10 op
Choose 2 courses
555285A: Project management, 5 op
555242A: Product development, 5 op
555226A: Operations and Production, 5 op

Module of the Option, Water and Geo Engineering

A432235: Module of the Option/Water and Geo Engineering, 60 op
Compulsory, choose also 20 ECTS from one of the electives
488133A: Environmental Impact Assessment, 5 op
488110S: Water and Wastewater Treatment, 5 op
488108S: Groundwater Engineering, 5 op
488127S: Field measurements, site investigations and geotechnical tests, 5 op
488128S: Laboratory tests in water resources engineering, 5 op
488121S: Fundamentals of Civil Engineering, 5 op
488105A: Water Supply Networks, 5 op
488117S: Water Resources Management, 5 - 7,5 op
Water Engineering
488122S: Statistical Methods in Hydrology, 5 op
488124S: Advanced Course in Hydrology, 5 op
488113S: Basics of surface water quality modelling, 5 op
488123S: River Engineering and Hydraulic Structures, 5 op
488131S: Geoenvironmental Engineering, 5 op
Geo Engineering; you may also choose 488131S Geoenvironmental Engineering and 488123S River Engineering and Hydraulic Structures
488111S: Modelling in Geoenvironmental Engineering, 5 op
460163S: Foundation Engineering, 5 op
488132S: Cold Climate Engineering, 5 op

Supplementary Module (vähintään 30 op)

Course 488002S Practical Training, 3 ECTS is compulsory. All other courses student can choose free.

Advanced practical training

477005S: Advanced Practical Training, 5 op

Supplementary Module, Material Engineering

A432253: Supplementary Module, Material Engineering, 29,5 op
Compulsory
465101A: Introduction to materials for mechanical engineering, 5 op
465102A: Materials for mechanical engineering, 5 op
465107A: Introduction to physical metallurgy, 5 op
465115S: Processing and properties of steels, 5 op
Choose 10 ECTS
465105A: Research techniques for materials, 5 op
465063S: Microstructural changes in metallic alloys, 7 op
465064S: Strength of metal alloys, 7 op
465111S: Welding metallurgy, 8 op
465113S: Failure mechanisms in metals, 5 op
465116S: Rolling technology, 10 op

Master's Thesis (30 op)

Choose Master's Thesis 30 ECTS.

480429S: Maturity Test / Environmental Engineering, 0 op

Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

488152S: Advanced Course in Traffic Engineering, 5 op
488153A: Basics of Road Engineering, 5 op
488151A: Basics of Traffic Engineering, 5 op
477023A: Exercises of Process Engineering, 3 op
477303A: Mass Transfer, 3 op
477422A: Metallurgical Processes, 6 op
477003A: Practical Training for Exchange Students, 1 - 10 op
477321S: Research Ethics, 3 op
488154S: Road Design and Construction, 5 op
477010A: Special Exercise of Process Engineering, 3 - 10 op
477006S: Supplementary Practical Training, 5 op
488402S: Sustainable Development, 5 op
477421S: Thermodynamics in Metallurgy, 6 op
488125S: Water and Waste Water Networks, Advanced Course, 5 op
477008A: Working Life Skills, 1 - 10 op

Opintojaksojen kuvaukset

Tutkintorakenteisiin kuuluvien opintokohteiden kuvaukset

A431123: Basic Studies, Process Engineering, 70 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Basic Studies

477011P: Introduction to Process and Environmental Engineering I, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail

Opettajat: Sanna Taskila, Aki Sorsa

Opintokohteen kielet: Finnish

Leikkaavuudet:

470219A	Introduction to Process Engineering	3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Implementation during periods 1-2 on the autumn term

Learning outcomes:

The objective of this course is to give insight to the whole perspective of process and environmental engineering and to familiarise the students with the terminology involved. In addition, the objective is also to outline the connections between process and environmental engineering and other fields closely related to them.
After the course, the student can analyse the process and environmental engineering aspects of an industrial process. He/She can, for example, divide the process into unit processes, analyse the process or a chain of processes based on the material balances, identify and evaluate the significance of essential mechanical, chemical and transport phenomena, analyse the control and process design aspects of a process etc. He/She can also evaluate the significance of different aspects of process and environmental engineering to the overall production system when these aspects are further examined in forthcoming courses.

Contents:

The course is divided into the next eight separate themes: 1. Unit processes and material balances. 2. Environmental impacts and their classification. 3. Mechanical phenomena. 4. Momentum, heat and mass transfer phenomena. 5. Chemical reactions and reactors. 6. The possibilities of biological process engineering. 7. Process dynamics and control. 8. Process measurements and measurability.

Mode of delivery:

Group work and contact lectures supporting those

Learning activities and teaching methods:

Assignments (8 altogether) carried out in small groups and contact lectures supporting them (16 hours)

Target group:

Bachelor’s degree students in the study fields of process and environmental engineering

Prerequisites and co-requisites:

None

Recommended optional programme components:

The course serves as an introduction to the studies in process and environmental engineering

Recommended or required reading:

The material is provided during the contact lectures and through the course webpages. It is also expected that the students seek material for completing the assignments independently.

Assessment methods and criteria:

The assignments (altogether 8) covering the course themes carried out in small groups.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilises a numerical grading scale 1-5 and fail.

Person responsible:

Dr Aki Sorsa

Working life cooperation:

No

Other information:

The assessment method utilized requires the active attendance to the group work and contact lectures from the beginning of the course

488010P: Introduction to Process and Environmental Engineering II, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Fabritius, Timo Matti Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

488011P	Introduction to Environmental Engineering	5.0 op
477012P	Introduction to Automation Engineering	5.0 op

ECTS Credits:

5 cr / 135 hours of work

Language of instruction:

Available only in Finnish

Timing:

The course is given in the spring semester, during periods III and IV. It is recommended to complete the course at the 1st spring semester.

Learning outcomes:

Students can examine industrial processes using the methods and perspectives of process and environmental engineering (e.g. material management, phenomenon-based considerations and automation) and they recognize the role of different areas of the process and environmental engineering, when these areas are considered in the forthcoming courses.

Contents:

1. Environmental thinking and industrial ecology. 2. Materials in production processes. 3. Water resources and land use. 4. Municipal and industrial water supply. 5. PI diagrams. 6. Process design. 7. Control and operation of processes.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Group exercises and contact-education (14 h) that supports these exercises. Available only in Finnish.

Target group:

Students of process and environmental engineering

Prerequisites and co-requisites:

None

Recommended optional programme components:

This course is an introduction to the other courses of process and environmental engineering

Recommended or required reading:

Material will be distributed during lectures and via course www-site

Assessment methods and criteria:

Group exercises. Please note that the course is not available in English, but only in Finnish.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Timo Fabritius

Working life cooperation:

No

Other information:

It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun.

031010P: Calculus I, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Ilkka Lusikka

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay031010P	Calculus I (OPEN UNI)	5.0 op

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Autumn semester, periods 1-3.

Learning outcomes:

After completing the course the student identifies concepts of vector algebra and can use vector algebra for solving problems of analytic geometry. The student can also explain basic characteristics of elementary functions and is able to analyse the limit and the continuity of real valued functions of one variable. Furthermore, the student can solve problems associated with differential and integral calculus of real valued functions of one variable.

Contents:

Vector algebra and analytic geometry. Limit, continuity, differential and integral calculus and applications of real valued functions of one variable. Complex numbers.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 55 h / Group work 22 h.

Target group:

-

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Grossmann, S.I.: Calculus of One Variable; Grossmann, S.I.: Multivariable Calculus, Linear Algebra and Differential Equations (partly); Adams, R.A.: A Complete Course Calculus (partly).

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

031075P: Calculus II, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Ilkka Lusikka

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay031075P	Calculus II (OPEN UNI)	5.0 op
031011P	Calculus II	6.0 op

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Spring, period 3

Learning outcomes:

The course gives the basics of theory of series and differential and integral calculus of real and vector valued functions of several variables. After completing the course the student is able to examine the convergence of series and power series of real terms. Furthermore, the student can explain the use of power series e.g. in calculating limits and is able to solve problems related to differential and integral calculus of real and vector valued functions of several variables.

Contents:

Sequences, series, power series and Fourier series of real terms. Differential and integral calculus of real and vector valued functions of several variables.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h / Group work 28 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the course Calculus I.

Recommended optional programme components:

-

Recommended or required reading:

Kreyszig, E.: Advanced Engineering Mathematics; Grossmann, S.I.: Multivariable Calculus, Linear Algebra and Differential Equations.

Assessment methods and criteria:

Intermediate exams or a final exam.

Grading:

Numerical grading scale 1-5.

Person responsible:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

031076P: Differential Equations, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay031076P	Differential Equations (OPEN UNI)	5.0 op
800320A	Differential equations	5.0 op
031017P	Differential Equations	4.0 op

Ei opintojaksokuvauksia.

031078P: Matrix Algebra, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Matti Peltola
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay031078P	Matrix Algebra (OPEN UNI)	5.0 op
031019P	Matrix Algebra	3.5 op

Ei opintojaksokuvauksia.

031021P: Probability and Mathematical Statistics, 5 op

Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Kemppainen
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay031021P	Probability and Mathematical Statistics (OPEN UNI)	5.0 op

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Spring semester, periods 4-6

Learning outcomes:

After completing the course the student knows the key concepts of probability and the most important random variables and is able to use them in calculating probabilities and parameters of probability distributions. In addition, the student is able to analyze statistical data by calculating interval and point estimates for the parameters. The student is also able to formulate statistical hypotheses and test them.

Contents:

The key concepts of probability, random variable, parameters of probability distributions, estimation of parameters, hypothesis testing.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 44 h/Exercises 22 h/Self-study 68 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisites are the course 031010P Calculus I and some parts of the course 031011P Calculus II.

Recommended optional programme components:

-

Recommended or required reading:

Milton, J.S., Arnold, J.C. (1992): Introduction to Probability and Statistics.

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Jukka Kemppainen

Working life cooperation:

-

Other information:

-

761111P: Basic mechanics, 5 op

Voimassaolo: 01.01.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761118P	Mechanics 1	5.0 op
761118P-02	Mechanics 1, lab. exercises	0.0 op
761118P-01	Mechanics 1, lectures and exam	0.0 op
ay761111P	Basic mechanics (OPEN UNI)	5.0 op
761101P	Basic Mechanics	4.0 op

ECTS Credits:

5 credits

Language of instruction:

The lectures will be in Finnish. The textbook is in English and exercises are selected from the textbook. For further information, contact the responsible person of the course.

Timing:

Autumn

Learning outcomes:

The student is able to describe the basic concepts of mechanics and to apply those when solving the problems related to mechanics.

Contents:

We encounter many phenomena related to mechanics in our everyday life. Most engineering sciences are based on mechanics and mechanics forms the basis of many other fields of physics, including modern physics.
Contents in brief: Short summary of vector calculus. Kinematics, projectile motion and circular motion. Newton's laws of motion. Work and different forms of energy. Momentum, impulse and collisions. Rotational motion and moment of inertia. Torque and angular momentum. Rigid body equilibrium problems. Gravitation. Periodic motion. Fluid mechanics.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 32 h, 8 exercises (16 h), 2 laboratory exercises (8 h), self-study 77 h

Target group:

For the students of the University of Oulu

Prerequisites and co-requisites:

Knowledge of vector calculus and basics of differential and integral calculus

Recommended optional programme components:

No alternative course units or course units that should be completed simultaneously

Recommended or required reading:

Text book: H.D. Young and R.A. Freedman: University physics, Addison-Wesley, 13th edition, 2012, chapters 1-14. Also older editions can be used.
Lecture material: Finnish lecture material will be available on the web page of the course.
Course material availability can be checked here.

Assessment methods and criteria:

Three mini examinations and end examination or final examination
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Anita Aikio

Working life cooperation:

No work placement period

Other information:

https://noppa.oulu.fi/noppa/kurssi/761111P/etusivu

Compulsory

761111P-01: Basic mechanics, lectures and exam, 0 op

Voimassaolo: 01.01.2015 -

Opiskelumuoto: Basic Studies

Laji: Partial credit

Vastuuyksikkö: Field of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761118P-01 Mechanics 1, lectures and exam 0.0 op
761118P-02 Mechanics 1, lab. exercises 0.0 op
761101P Basic Mechanics 4.0 op

Ei opintojaksokuvauksia.

761111P-02: Basic mechanics, lab. exercises, 0 op

Voimassaolo: 01.01.2015 -
Opiskelumuoto: Basic Studies
Laji: Partial credit
Vastuuyksikkö: Field of Physics
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

761118P-01 Mechanics 1, lectures and exam 0.0 op
761118P-02 Mechanics 1, lab. exercises 0.0 op
761101P Basic Mechanics 4.0 op

Ei opintojaksokuvauksia.

761113P: Electricity and magnetism, 5 op

Voimassaolo: 01.01.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Field of Physics
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

761119P Electromagnetism 1 5.0 op
761119P-01 Electromagnetism 1, lectures and exam 0.0 op
761119P-02 Electromagnetism 1, lab. exercises 0.0 op
766319A Electromagnetism 7.0 op
761103P Electricity and Magnetism 4.0 op

ECTS Credits:

5 credits

Language of instruction:

The lectures will be in Finnish. The textbook is in English and exercises are selected from the textbook. For further information, contact the responsible person of the course.

Timing:

Spring

Learning outcomes:

The student is able to describe the basic concepts of electricity and magnetism and to apply those when solving the problems related to electromagnetism.

Contents:

Electromagnetic interaction is one of the four fundamental interactions in physics and many phenomena like light, radio waves, electric current, magnetism and formation of solid matter are based on electromagnetism. The current technological development is largely based on applications of electromagnetism in energy production and transfer, telecommunications and information technology.

Contents in brief: Coulomb's law. Electric field and potential. Gauss's law. Capacitors and dielectrics. Electric current, resistors, electromotive force and DC circuits. Magnetic field, motion of a charged particle in electric and magnetic fields, and applications. Ampère's law and Biot-Savart law. Electromagnetic induction and Faraday's law. Inductance and inductors. R-L-C circuits, alternating current and AC circuits.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 32 h, 6 exercises (12 h), 2 laboratory exercises (8 h), self-study 81 h

Target group:

For the students of the University of Oulu.

Prerequisites and co-requisites:

Knowledge of vector calculus and basics of differential and integral calculus are needed.

Recommended optional programme components:

No alternative course units or course units that should be completed simultaneously

Recommended or required reading:

Text book: H.D. Young and R.A. Freedman: University physics, Addison-Wesley, 13th edition, 2012, chapters 21-31. Also older editions can be used.
Lecture material: Finnish lecture material will be available on the web page of the course.
Course material availability can be checked here.

Assessment methods and criteria:

Three mini examinations and end examination or final examination
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Anita Aikio

Working life cooperation:

No work placement period

Other information:

https://wiki.oulu.fi/display/761113P/

Compulsory

761113P-01: Electricity and magnetism, lectures and exam, 0 op

Voimassaolo: 01.01.2015 -

Opiskelumuoto: Basic Studies

Laji: Partial credit

Vastuuyksikkö: Field of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761119P	Electromagnetism 1	5.0 op
761119P-01	Electromagnetism 1, lectures and exam	0.0 op
761119P-02	Electromagnetism 1, lab. exercises	0.0 op
766319A	Electromagnetism	7.0 op
761103P	Electricity and Magnetism	4.0 op
761121P	Laboratory Exercises in Physics 1	3.0 op

Ei opintojaksokuvauksia.

761113P-02: Electricity and magnetism, lab. exercises, 0 op

Voimassaolo: 01.01.2015 -
Opiskelumuoto: Basic Studies
Laji: Partial credit
Vastuuyksikkö: Field of Physics
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

761119P	Electromagnetism 1	5.0 op
761119P-01	Electromagnetism 1, lectures and exam	0.0 op
761119P-02	Electromagnetism 1, lab. exercises	0.0 op
766319A	Electromagnetism	7.0 op
761103P	Electricity and Magnetism	4.0 op

Ei opintojaksokuvauksia.

780117P: General and Inorganic Chemistry A, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Field of Chemistry
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay780117P	General and Inorganic Chemistry A (OPEN UNI)	5.0 op

ECTS Credits:

5 credits /134 hours of work

Language of instruction:

Finnish

Timing:

1st autumn

Learning outcomes:

After this course the student should understand basic concepts of chemistry as described in international general chemistry curriculum.

Contents:

Basic concepts of chemistry, chemical formula, chemical reaction, chemical equation, oxidation-reduction reactions, stoichiometry, gases, chemical equilibrium, acids and bases, additional aspects of acid-base equilibria, solubility and complex-ion equilibria.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

32 hours of lectures and applications, 20 hours of exercises and 82 hours of self-study

Target group:

Biochemistry, Chemistry, Biology, Geology, Mechanical Engineering, Process Engineering, Environmental Engineering compulsory. In the entity of 25 credits (minor studies), compulsory. Physical sciences, Mathematical sciences, optional.

Prerequisites and co-requisites:

Upper secondary school chemistry

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Petrucci, R.H., Herring, F.G., Madura, J.D. ja Bissonnette, C.: General Chemistry: Principles and Modern Applications, 10. edition (also 7., 8. and 9. edition), Pearson Canada Inc., Toronto, 2011. Chapters 1 – 6, 15 – 18.

Assessment methods and criteria:

Two intermediate examinations or one final examination Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

Person responsible:

Lecturer Leena Kaila

Working life cooperation:

No

Other information:

No

780116P: Introduction to Organic Chemistry, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Chemistry

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay780116P	Introduction to Organic Chemistry (OPEN UNI)	5.0 op

ECTS Credits:

5 credits /134 hours of work

Language of instruction:

Finnish. Book-examination in English as well.

Timing:

1st autumn and 1st spring

Learning outcomes:

After this course, the student can explain organic chemistry fundamentals, basic concepts and terminology, can use them for the description of organic chemistry phenomena. He/she can name organic structures, explain their properties, deduce basic reaction types and solve their mechanisms.

Contents:

Basic reactions of organic compounds, basic principles of stereochemistry and reaction mechanisms: Addition, elimination, substitution, including electrophilic aromatic substitution, reactions of carbonyl group. Applications.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

42 hours of lectures plus 12 hours of exercises, 80 hours of independent self-study

Target group:

Biochemistry, Chemistry, Biology, Process Engineering, Environmental Engineering and in the study entity of 25 credits, compulsory. Physical Sciences, Geology, Geograhpy, Mathematical Sciences, optional.

Prerequisites and co-requisites:

Upper secondary school chemistry

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Hart, H., Hart, D.J. and Craine, L.E.: Organic Chemistry: A Short Course, 10 th ed. or the newer edition, Houghton Mifflin Boston, 1999; Hart, H., Hart, D.J. and Craine, L.E.: Study Guide & Solutions Book, Organic Chemistry: A Short Course, 10th ed. or the newer edition, Houghton Mifflin Boston, 1999.

Assessment methods and criteria:

Two intermediate examinations or one final examination Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr. Johanna Kärkkäinen

Working life cooperation:

No

Other information:

No

780123P: Introductory Laboratory Works in Chemistry, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Chemistry

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

5 credits /134 hours of work

Language of instruction:

Finnish

Timing:

1st autumn or 1st spring

Learning outcomes:

After this course, the student can apply laboratory safety instructions and act accordingly. He/she can communicate by using basic laboratory terminology and work in a group under the guidance. The student identifies basic laboratory equipment and can use them properly. He/she recognizes the importance of the planning of the laboratory work. The student is able to utilize the basic chemistry techniques and determination methods in the given task. Furthermore, the student can also make laboratory notes and write a report on the performed task.

Contents:

Laboratory safety, basic laboratory equipment, basic chemistry techniques and determination methods as well as some of their theoretical background, carrying out chemical synthesis and checking the purity of the product, problems related to the studied determination methods, keeping a laboratory notebook, writing a report.

Mode of delivery:

Supervised laboratory work, independently done preparatory problems.

Learning activities and teaching methods:

Safety in laboratory 2 hours, 65 hours of laboratory work + demonstrations + problems, 67 hours of self-study.

Target group:

Biochemistry, Process Engineering, Environmental engineering, compulsory. In the entity of 25 credits, compulsory. Physical Sciences, Geology, Mathematical Sciences, optional.

Prerequisites and co-requisites:

General and Inorganic Chemistry A (780117P, 5 cr) and Introduction to Organic Chemistry (780116P, 5 cr). Student is allowed to participate to the course simultaneously when participating the prerequisites. Attendance at the lecture of Safety in laboratory is compulsory.

Recommended optional programme components:

Participation in the courses General and Inorganic Chemistry A (780117P, 5 cr) and Introduction to Organic Chemistry (780116P, 5 cr).

Recommended or required reading:

Instruction Book (in Finnish): Kemian perustyöt

Assessment methods and criteria:

Accomplishment of the course requires accepted preparatory problems, laboratory exercises, problems related to them and final examination. Laboratory exercises and final examination has to be completed within next two terms.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes verbal grading scale pass/fail.

Person responsible:

Ph.D. Teija Kangas

Working life cooperation:

No

Other information:

Attendance at the lecture of Safety at work is compulsory. The exercises must be done before each laboratory assignment. Deadline of the written report is binding. Failure will lead to the renewal of the work.

477000P: Planning of Studies and Career, 1 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Saara Luhtaanmäki

Opintokohteen kielet: Finnish

Leikkaavuudet:

030001P	Orientation Course for New Students	1.0 op

ECTS Credits:

1 ECTS /28 hours of work

Language of instruction:

Finnish

Timing:

The course unit is given in the autumn semester, during periods 1 and 2

Learning outcomes:

The aim of the course is to introduce new students to the university, academic studies, the studies of his /her degree programme in the Faculty of Technology

Contents:

Issues related to the beginning of the studies. Goals, structures and contents of the studies in the Faculty of Technology. Preparing a Personal Study Plan. Study techniques and the library.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Tutorials, orientations days organized by the faculty and by the degree programmes, independent studying

Target group:

All first year students in the degree programmes of process engineering and environmental engineering

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Study guide, Teekkarin työkirja

Assessment methods and criteria:

Participation to the tutorials and information sessions and preparing a Personal Study Plan. Student must participate 3 times in the seminars of the course Advanced Practical Training (477005S) and in two topic lectures (Ajankäyttö ja suunnitelmallinen opiskelu, Oppiminen on taitolaji)
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Verbal scale Passed/Failed

Person responsible:

Study councellor Saara Luhtaanmäki

Working life cooperation:

No

Other information:

-

030005P: Information Skills, 1 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Faculty of Technology

Arvostelu: 1 - 5, pass, fail

Opettajat: Sassali, Jani Henrik, Ursula Heinikoski

Opintokohteen kielet: Finnish

Leikkaavuudet:

030004P	Introduction to Information Retrieval	0.0 op

ECTS Credits:

1 ECTS credit

Language of instruction:

Finnish

Timing:

2nd or 3rd year

Learning outcomes:

Students know the different phases of information retrieval process and basic techniques of scientific information retrieval. They will find the most important reference databases of their discipline and know how to evaluate information sources and retrieval results.

Contents:

Retrieval of scientific information, the retrieval process, key databases of the discipline, and evaluation of information retrieval and information sources.

Mode of delivery:

Blended teaching: classroom training, web-based learning material and exercises in Optima environment, a final assignment on a topic of the student's own choice

Learning activities and teaching methods:

Training sessions 8h, group working 7h, self-study 12h

Target group:

Compulsory for all students of the Faculty of Technology, the Faculty of Information Technology and Electrical Engineering and the Faculty of Architecture. In the Faculty of Science compulsory for students of biology, physics, geosciences, chemistry and geography. Optional for students of biochemistry and mathematics.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Web learning material https://wiki.oulu.fi/display/030005P.

Assessment methods and criteria:

Passing the course requires participation in the training sessions and successful completion of the course assignments.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

pass/fail

Person responsible:

Science and Technology Library Tellus, tellustieto (at) oulu.fi

Working life cooperation:

-

Other information:

-

902011P: Technical English 3, 6 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Negotiated Education

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Proficiency level:

CEFR B2 - C1

Status:

This course is compulsory for the students who have chosen English as their foreign language. (See the foreign language requirements for your own degree programme.)

Required proficiency level:

English must have been the A1 or A2 language at school or equivalent English skills acquired otherwise. If you need to take English, but lack this background, please get in touch with the Languages and Communication contact teacher for your department to discuss individual solutions.

ECTS Credits:

6 ECTS credits (The workload is 160 hours.)
STUDENTS OF ENGINEERING: The course consists of 3 x 2-ECTS modules.

STUDENTS OF ARCHITECTURE: The course consists of 2 x 3-ECTS modules.

Students with the matriculation exam grade *Laudatur* or *Eximia cum laude approbatur* will be exempted from part of the course (2 ECTS credits).

Language of instruction:

English

Timing:

STUDENTS OF ENGINEERING:
PYO, KO, TuTa: *1st & 2nd* years of studies, beginning 1st year autumn.
SO & CSE: 2nd & 3rd years of studies, beginning 2nd year autumn.
STUDENTS OF ARCHITECTURE:
1st & 2nd years of studies, beginning 1st year spring and continuing 2nd year autumn.

Learning outcomes:

By the end of the course, you will be able to

- demonstrate efficient strategies and methods for developing and maintaining your English proficiency
- communicate using the core vocabulary required for professional language use in your field
- apply language skills, intercultural awareness and presentation techniques necessary for working in a multicultural environment
- use language, culture and communication skills at a B2-C1 CEFR level in accordance with your own professional needs.

Contents:

In this course, you will focus on developing oral and written English language skills which enable you to follow developments in your own professional field and manage successfully in an international, intercultural working environment.

STUDENTS OF ENGINEERING:
The course consists of three modules:

1. first, **Professional English for Technology** (PET, 2 ECTS credits),
2. then **two modules** (2 ECTS credits each) from a free-choice module menu, in which each module has its own content. These modules allow you to develop further skills in specific core areas. Read the module descriptions with care so that you choose modules which match your own needs, interests and level.

   TuTa students, however, take ONE module from the free-choice menu and then, in second year autumn, the Business Plan module, which is integrated with a course in their own department (*555222A Tuotantotalouden harjoitustyöt*) .

STUDENTS OF ARCHITECTURE:
The course consists of two modules:
See the course description of each module (902011P-38 module A and 902011P-39 module B for a detailed explanation of the course content.

Mode of delivery:

STUDENTS OF ENGINEERING: The mode of delivery varies according to the modules you take. See the course descriptions for the individual modules.
STUDENTS OF ARCHITECTURE: face-to-face teaching in the premises of your own department and independent study

Learning activities and teaching methods:

STUDENTS OF ENGINEERING: The teaching methods and learning activities depend on which free-choice modules you choose. See the course descriptions for the individual modules.
STUDENTS OF ARCHITECTURE:
The classroom teaching comprises about 50% of the total student workload for the course and includes mini-lectures, group and teamwork, student presentations. The independent work component comprises online work and independent study in preparation for classroom activities.

Target group:

Students of the Faculty of Technology
- all Engineering Departments
- the Department of Architecture

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Materials will be provided by the teacher.

Assessment methods and criteria:

Assessment methods vary according to the individual modules taken. The assessment criteria are based on the learning outcomes of the module.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

pass / fail.

Person responsible:

Each department in the Technical Faculty has its own Languages and Communication contact teacher for questions about English studies.

Working life cooperation:

-

Other information:

See the Languages and Communication Study Guide, English, TTK.

901008P: Second Official Language (Swedish), 2 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Negotiated Education

Opintokohteen kielet: Swedish

Leikkaavuudet:

ay901008P	Second Official Language (Swedish) (OPEN UNI)	2.0 op

Proficiency level:

B1/B2/C1 (Common European Framework of Reference)

Status:

This course is compulsory to all students except those who have at least 60 ECTS credits of Swedish studies in their degrees. The language proficiency provided by the course unit is equivalent to the language proficiency required of a state official with an academic degree working in a bilingual municipality area (Act 424/03 and Decree 481/03).
According to the requirements of the law, the student must be able to use Swedish both orally and in writing in various professional situations. Achieving this kind of proficiency during a course unit that lasts for only one semester requires that the student has already achieved the necessary starting proficiency level prior to taking the course.

Required proficiency level:

The required starting proficiency level for students of all faculties is a grade of 7 or higher from the Swedish studies at secondary school (B-syllabus) or equivalent knowledge AND a passing grade from the proficiency test held at the beginning of the course unit. Based on this proficiency test the students are directed to brush up on their language skills if it is deemed necessary; mastering basic vocabulary and grammar is a prerequisite to achieving the necessary language proficiency for the various communication situations one faces in professional life.
If a student has not completed Swedish studies (B-language) at secondary school with a grade of 7 or higher, or his/her language skills are otherwise lacking, he/she must achieve the required proficiency level BEFORE taking this compulsory Swedish course.

ECTS Credits:

2 ECTS credits

Language of instruction:

Swedish

Timing:

Students of the School of Architecture: autumn term of 1st year of studies
Studenst of Students of Industrial Engineering and Management : autumn semester of the 2nd year of studies
Students of Process Engineering and Environmental Engineering: autumn or spring semester of the second year of studies
Mechanical Engineering: autumn or spring semester of the third year of studies
The Faculty of Information Technology and Electrical Engineering: Students of Electrical Engineering and Computer Science Engineering: Autumn or spring term of 1st year of studies.

Learning outcomes:

Upon completion of the course unit the student should be able to read and understand texts from his/her academic field and make conclusions based on them. The student should be able to write typical professional emails and short reports. He/she should be able to carry himself/herself according to Swedish etiquette when acting as host or guest. The student should also be able to discuss current events and special field-specific matters, use the vocabulary of education and plan and give short oral presentations relating to his/her own field.

Contents:

Communicative oral and written exercises, which aim to develop the student's Swedish proficiency in areas relevant to his/her academic field and future professional tasks. The student practises oral presentation and pronunciation. Situational exercises done individually and in pairs and groups. Discussions in small groups. Current texts about the student's special field. Written exercises relating to the student's professional field. Practising presentation skills.

Mode of delivery:

Contact teaching

Learning activities and teaching methods:

1 x 90 minutes of contact teaching per week and self-directed study, 53 hours per course.

Target group:

See Timing

Prerequisites and co-requisites:

See Required Proficiency Level

Recommended optional programme components:

-

Recommended or required reading:

Study material will be provided by the teacher.

Assessment methods and criteria:

The course unit focuses on improving both oral and written language skills and requires active attendance and participation in exercises, which also require preparation time. 100% attendance is required. The course unit tests both oral and written language skills.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Oral and written language proficiencies are tested separately and assessed using the so called KORU-criteria (publication of HAMK University of Applied Sciences, 2006). Separate grades will be awarded for the successful completions of both oral and written portions of the course unit: the possible passing grades are **satisfactory skills and good skills** (see language decree 481/03). The grades are based on continuous assessment and testing.

Person responsible:

See contact teachers on the Language and Communication home page http://www.oulu.fi/languagesandcommunication/student_counselling

Working life cooperation:

-

Other information:

Students sign up for teaching in WebOodi. A student can only sign up for one teaching group. When signing up , it is imperative that the student fills in his/her university email address (paju.oulu.fi), major subject and Swedish grades attained during secondary education in the Further Information field. Information in sign-up periods and course unit timetables can be found in WebOodi.

A431125: Intermediate Studies, Process Engineering, 60 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Intermediate studies

477121A: Particle Technology, 5 op

Voimassaolo: 01.08.2015 - 31.07.2022

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477120A	Fluid and Particle Engineering	5.0 op
477101A	Fluid and Particle Engineering I	3.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

Finnish

Timing:

Implementation in spring term, period 4

Learning outcomes:

Upon completion of the course, a student should be able to identify the mainline mechanical processes in process industry enhancing the degree of upgrading, as well as recovery operations related to those mechanical main processes. The student is able to identify the equipments related to the mechanical processes and can explain their purpose of use and their operational principles.

Contents:

Granular material and sampling, particle size and particle size distribution, specific surface area, basics in grinding, crushing, sieving and mineral concentration, froth flotation, mineral concentration methods based on density difference, magnetic concentration and other concentration methods, granulation, separation from suspensions

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

The implementation methods of the course are varying. Lectures and exercises max. 48 h. A part of teaching can be replaced by home or group works.

Target group:

: Bachelor students in process and environmental engineering

Prerequisites and co-requisites:

Introduction to process and environmental engineering I (477011P)

Recommended optional programme components:

-

Recommended or required reading:

Lecture materials and other materials that will be announced at the lectures

Assessment methods and criteria:

This course utilizes continuous assessment including lecture diaries and three intermediate exams. Alternatively, the course can also be completed by taking the end exam.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Ari Ämmälä

Working life cooperation:

No

Other information:

-

477122A: Bulk Solids Handling, 5 op

Voimassaolo: 01.08.2015 - 31.07.2023

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477120A	Fluid and Particle Engineering	5.0 op
477102A	Fluid and Particle Technology II	4.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

Finnish

Timing:

Implementation in period 2 (autumn term)

Learning outcomes:

Upon completion of the course, a student should be able to identify auxiliary mechanical unit processes as well as equipments and phenomena related to them. In addition, the student can explain application of unit processes and can describe their operational principles.

Contents:

Liquid and susensions: fluid mechanics, pumping and hydraulic transport, mixing. Gases and aerodispersions: gas dynamics, compression, pneumatic transport. Granular bulk material: properties, storage, mechanical transportation, fluidization.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

The implementation methods of the course vary. Lectures and exercises max. 48 h. A part of teaching can be replaced by home or group works.

Target group:

Bachelor students in process or environmental engineering

Prerequisites and co-requisites:

477101A Particle Technology

Recommended optional programme components:

-

Recommended or required reading:

Lecture materials and other materials that will be announced at the lectures

Assessment methods and criteria:

This course utilizes continuous assessment including lecture diaries and three intermediate exams. Alternatively, the course can also be completed by taking the end exam.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Ari Ämmälä

Working life cooperation:

No

Other information:

-

488309A: Biocatalysis, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

488212A	Fundamentals of catalysis	5.0 op
488308A	Enzyme Technology	2.0 op
488301A	Microbiology	3.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course is given in autumn semester during period 1. It is recommended to complete the course in the 3rd year.

Learning outcomes:

After completing this course, the student will be able to define what biocatalysts are. Student is able to describe in which way different microbes and enzymes can be applied as biocatalysts and can give examples how biocatalysts are applied. The student will be able to evaluate the cultivation and growth of microbes and the use of them in the production of different products. The student recognizes the effect of the structure and the reaction conditions to the function of enzymes, and can explain the basic principles of enzymatic reactions and enzyme kinetics. Student will be able to judge how microbes and enzymes could be applied in industry.

Contents:

Microbes and enzymes as biocatalysts and the use of them in industry. The structural and functional characteristics, metabolism, products from metabolism, physiology, and growth of prokaryotic and eukaryotic cells from industrial point of view. The structure and function of enzymes, enzymatic reactions and kinetics.

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

Lectures 50 h / home work and web-based learning 10 h / self-study 73 h

Target group:

Bachelor students in process engineering and environmental engineering

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout; Madigan MT, Martinko JM & Parker J: Brock Biology of Micro-organisms. Prentice Hall, 13. and newer edition. 978-0-321-73551-5; Illanes A (ed.): Enzyme Biocatalysis - Principles and Applications. Springer. 978-90-481-7854-4; Aittomäki E et al.: Bioprosessitekniikka. WSOY 2002. 951-26995-6; other material announced in the lectures.

Assessment methods and criteria:

Lectures, intermediate exams (välikokeet) or final examination and home work. Grade will be composed of home work and intermediate exams (välikokeet) or final examination.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Johanna Panula-Perälä

Working life cooperation:

No

Other information:

-

488052A: Introduction to Bioproduct and Bioprocess engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488054A	Introduction to Bioproduct and Bioprocess engineering	5.0 op
488302A	Basics of Biotechnology	5.0 op
477103A	Pulp and Paper Technology	3.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course is held in spring semester during period 3. It is recommended to complete the course in the 3rd (Bachelor's) year

Learning outcomes:

After completing this course, a student should be able to identify key renewable natural resources and their sustainable and economical processing via mechanical, chemical and biotechnological methods. The student is able to recognize the major properties of the bioproducts and their use in different applications.

Contents:

Renewable raw materials and their properties, value chains of biomass processing, recycling of biomaterials, bioenergy, and economical and environmental aspects. Industrial biotechnology for food and pharmaceutical applications, materials industries and environmental applications.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures 48 h/ self-study 85 h.

Target group:

Bachelor students in process engineering and environmental engineering.

Prerequisites and co-requisites:

488309A Biocatalysis or respective knowledge in biocatalysis.

Recommended optional programme components:

-

Recommended or required reading:

Lecture materials and other materials that will be announced at the lectures. Supplementary material: Book series: Fapet Oy. Papermaking Science and Technology; Aittomäki E et al.: Bioprosessitekniikka. WSOY 2002. 951-26995-6.

Assessment methods and criteria:

Lectures, intermediate exams and/or final exam. Grade will be composed of lecture exams and/or final exam. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Johanna Panula-Perälä, Adjunct professor Ari Ämmälä

Working life cooperation:

No

Other information:

-

477401A: Thermodynamic Equilibria, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

Leikkaavuudet:

470611A	Metallurgy Processes	7.0 op

ECTS Credits:

5 cr / 135 hours of work

Language of instruction:

Available only in Finnish

Timing:

The course is given in the autumn semester, during period II. It is recommended to complete the course at the 2nd year of Bachelor's studies.

Learning outcomes:

Student is capable of defining chemical equilibria of the systems that are related to industrial processes and understands the relevance of equilibria (and their computational determination) as a part of process analysis, planning and control. Additionally, (s)he can define a meaningful system to be considered in computation thermodynamics; i.e. (s)he can create a computationally solvable problem based on technical problem that in itself is not solvable computationally.

Contents:

Concepts of entalphy (H), entropy (S) and Gibbs free energy (G). The effect of temperature and pressure on H, S and G. Chemical and phase equilibria. Activity and activity coefficient. Calculation of thermodynamic equilibria using equilibrium constant as well as Gibbs free energy minimisation.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Lectures, software exercise as well as other exercises. Available only in Finnish.

Target group:

Students of process and environmental engineering

Prerequisites and co-requisites:

’Basic Principles in Chemistry’ and ’Material and Energy Balances’ as prerequisities

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a education that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Material will be distributed during lectures and exercises.

Assessment methods and criteria:

Students are required to make a portfolio consisting of a learning diary and exercices. Please note that the course is organised only in Finnish.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Eetu-Pekka Heikkinen

Working life cooperation:

No

Other information:

It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun. Course webpage (in Finnish): http://www.oulu.fi/pyomet/477401a.

477201A: Material and Energy Balances, 5 op

Voimassaolo: 01.08.2005 - 31.12.2019

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tiina Leiviskä

Opintokohteen kielet: Finnish

Leikkaavuudet:

477221A Material and Energy Balances 5.0 op
470220A Fundamentals of Chemical Process Engineering 5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish. The course can be completed in English as a book examination.

Timing:

Autumn period 1

Learning outcomes:

The student is able to formulate material and energy balances for a process by taking into account the restrictions set by reaction stoichiometry. The student knows how the created mathematical formulation can be exploited in process consideration.

Contents:

Formulation of material and energy balances by taking into account the effects of chemical reactions.

Mode of delivery:

Lectures and group exercise

Learning activities and teaching methods:

Lectures 40h, group work 10h and self-study 80h

Target group:

Bachelor students in of Process or Environmental Engineering

Prerequisites and co-requisites:

Basics from the course Introduction to Process Engineering

Recommended optional programme components:

-

Recommended or required reading:

Reklaitis, G.V.: Introduction to Material and Energy Balances. John Wiley & Sons, 1983. ISBN 0-471-04131-9.

Assessment methods and criteria:

During the course, there are two intermediate exams and both of them must be passed. Alternatively student can participate in final exam after the course. In addition to this, the students will be making a group exercise, which will be evaluated.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr Tiina Leiviskä

Working life cooperation:

No

Other information:

-

477222A: Reactor Analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477202A Reactor Analysis 4.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Period 2 (autumn term)

Learning outcomes:

By completing the course the student is able to explain the determination methods of the reaction rate from experimental data and he/she can illustrate the basics of deterministic modelling. On that basis, the student has skills to analyse the behaviour of ideal reactors and to perform initial reactor selection and sizing.

Contents:

Elementary reactions, kinetics of homogenous reactions. Reaction rate on the basis of experimental data. Modelling of ideal reactors. Yield, selectivity and reactor size. Heuristics for selecting reactor type and operating conditions.

Mode of delivery:

Lectures and small group exercises

Learning activities and teaching methods:

Lectures 40h and self-study 90h

Target group:

Bachelor students in process and environmental engineering, minor subject students

Prerequisites and co-requisites:

Objectives of 477201A Material and Energy Balances and 477401A Thermodynamic Equilibrium

Recommended optional programme components:

-

Recommended or required reading:

Lecture handouts. Levenspiel, O., Chemical Reaction Engineering. John Wiley & Sons, New York, 1972 (Chapters 1-8). Atkins, P.W.: Physical Chemistry, Oxford University Press, 2002. 7th Ed. (Parts) ISBN 0-19-879285-9.

Assessment methods and criteria:

Combination of examination and group exercises

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

No

Other information:

-

477052A: Fluid Mechanics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477301A Momentum Transfer 3.0 op

ECTS Credits:

5 ECTS / 133 hours of work.

Language of instruction:

Finnish, can be completed in English as a book examination.

Timing:

Implementation in spring semester during 3 rd period. It is recommended to complete the course at the second (Bachelolor's) spring semester. The course will be lectured first time in spring 2016.

Learning outcomes:

After the course the student is able to determine the viscosity of pure substances and mixtures and to estimate the effect of temperature and pressure on viscosity. The student is able to recognise the interactions between a solid body and flowing fluid and to distinguish the forces, their directions and to calculate their magnitudes. The student is able to formulate momentum balance equations and to solve these in order to calculate velocity distribution, flow rate and pressure drop. The student is able to distinguish laminar and turbulent flow regimes from others and is able to use the correct equations according to flow regime. After the course the student is able to design pipelines and other simple flow mechanical process equipment.

Contents:

Viscosity. Mechanism of momentum transfer. Creating and solving differential momentum balances. Friction factor. Macroscopic balances. Flow in pipes and open-channels.

Mode of delivery:

Face-to-face teaching in Finnish. Book examination in English.

Learning activities and teaching methods:

Lectures 45 h, homework 15 h and self-study 73 h. For foreign students written examination based on given literature.

Target group:

Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:

Knowledge of solving differential equations.

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Munson, B.R., Young, D.F. & Okiishi, T.H. Fundamentals of Fluid Mechanics.

Assessment methods and criteria:

This course utilizes continuous assessment. During the course there are 5 intermediate exams. The course can also be completed by final examination. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Eero Tuomaala

Working life cooperation:

No

Other information:

-

477322A: Heat and Mass Transfer, 5 op

Voimassaolo: 01.08.2015 - 31.07.2019

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477323A	Mass and Heat Transfer	5.0 op
477302A	Heat Transfer	3.0 op
477303A	Mass Transfer	3.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish, can be completed in English as a book examination

Timing:

Implementation in autumn semester during 1 st period. It is recommended to complete the course at the third (Bachelor's) autumn semester. The course will be lectured first time in autumn 2016.

Learning outcomes:

After passing the course the student knows what happens when heat is transferred by conduction, convection and radiation. The student can describe energy transfer with differential energy balances connected with momentum balances; In macro scale the student is able to solve practical heat transfer problems by correlating heat transfer coefficients to dimensionless flow and material characteristics; With the help of these transfer coefficients the student is capable of estimating the size of heat transfer equipment, especially heat exchangers and select the most suitable and profitable types; and to Sketch large heat nets and to diminish the costs of the equipments.
The student is able to use the pinch method which optimises the number of heat exchangers and total energy consumption. He/she is also able to apply the exergy principle to make work from thermal energy. With the aid of this principle he/she will be able to divide the costs of the used energy in right proportion based on the processing stage. He/she student is able to explain diffusion as a phenomenon and the factors affecting it. He/she is able to model mass transfer in simple systems by using the theory of Fick. The student is capable of modeling diffusion by differential mass balances. He/she recognises the special features of mass transfer in turbulent systems and the role of different transport phenomena in mass transfer equipment. He/she has rudimentary practical skills applicable to the scale-up of the equipment used for absorption.

Contents:

Mechanism of heat transfer. Creating and solving differential energy balances. Heat transfer coefficient. Macroscopic balances. Selection of a proper type of heat exchanger.Scale-up and design of a heat exchanger.Design of heat exchanger networks using pinch technology.Exergy analysis for the heat flows. Diffusion. The Fick law of diffusion. Mass transfer in simple systems. Differential mass balances. Models of mass transfer in turbulent systems. Interphase mass transfer. Absorption.

Mode of delivery:

Face-to-face teaching in Finnish. Book examination possible in English.

Learning activities and teaching methods:

Lectures 45 h, homework 15 h and self-study 73 h. For foreign students written examination based on given literature.

Target group:

Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:

Knowledge of solving differential equations.

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

(Will be announced later)

Assessment methods and criteria:

This course utilizes continuous assessment. During the course there are 5 intermediate exams. The course can also be completed by final examination. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Kaisu Ainassaari

Working life cooperation:

No

Other information:

-

477304A: Separation Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Muurinen, Esa Ilmari, Ainassaari, Kaisu Maritta

Opintokohteen kielet: Finnish

Leikkaavuudet:

470323A	Separation Processes	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work.

Language of instruction:

Finnish, can be completed in English as a book examination.

Timing:

Implementation in autumn semester during 2 nd periods. It is recommended to complete the course on the third (Bachelor's) autumn semester.

Learning outcomes:

After the course the student is able to define the position of separation processes based on mass transfer in process and environmental engineering. He/she is capable of solving phase equilibrium problems in multistage separations for binary mixtures. The student is able to explain the phenomena behind the following separation processes: distillation, absorption, stripping, liquid-liquid extraction, supercritical extraction, crystallisation, adsorption, chromatography separation, membrane separations, and reactive separations. He/she recognises the equipment used for these processes and is able to compare the methods to each other with heuristic rules.

Contents:

Separation processes based on mass transfer in process and environmental engineering. Phase equilibrium problems in multistage separations for binary mixtures. Phenomena behind the following separation processes: distillation, absorption, stripping, liquid-liquid extraction, supercritical extraction, crystallisation, adsorption, chromatography separation, membrane separations, and reactive separations. Equipment used for these processes and is able to compare the methods to each other with heuristic rules, etc.

Mode of delivery:

Face-to-face teaching in Finnish. Book examination possible in English.

Learning activities and teaching methods:

Lectures 40 h, exercises 20 h, homework 15 h and self-study 58 h. For foreign students written examination based on given literature and homework.

Target group:

Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:

Courses 477301A Momentum Transfer, 477302A Heat Transfer and 477303A Mass Transfer or 477052A Fluid Mechanics and 477312A Heat and Mass Transfer are recommended beforehand.

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Seader, J.D., Henley, E.J. & Roper, D.K.: Separation Processes Principles. Wiley 2011, 821 p.; Noble, R. D. & Terry, P.A.: Principles of Chemical Separations with Environmental Applications. Cambridge 2004, Cambridge University Press.321 p.

Assessment methods and criteria:

Homework assignments affect the course grade. Examination. The course can be completed with two intermediate exams or one final exam. Homework assignments affect the course grade. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Laboratory manager Dr Esa Muurinen

Working life cooperation:

No

Other information:

-

477203A: Process Design, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jani Kangas

Opintokohteen kielet: English

Leikkaavuudet:

480310A	Fundamentals of Process Design	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring period 4

Learning outcomes:

By completing the course the student is able to identify the activities of process design and the know-how needed at different design stages. The student can utilise process synthesis and analysis tools for creating a preliminary process concept and point out the techno-economical performance based on holistic criteria.

Contents:

Acting in process design projects, safety and environmentally conscious process design. Design tasks from conceptual design to plant design, especially the methodology for basic and plant design.

Mode of delivery:

Lectures and design exercises.

Learning activities and teaching methods:

Lectures 30h, group work 50h and self-study 50h

Target group:

Bachelor students

Prerequisites and co-requisites:

Objectives of 477202A Reactor analysis and 477304A Separation processes

Recommended optional programme components:

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Recommended or required reading:

Lecture handout, Seider, W.D., Seider, J.D. and Lewin, D.R. Product and process design principles: Synthesis, analysis and evaluation. John Wiley & Sons, 2004. (Parts) ISBN 0-471-21663-1

Assessment methods and criteria:

Combination of examination and design exercises.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

Scale 0-5

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

-

Other information:

-

477402A: Solid Inorganic Materials, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Tanskanen

Opintokohteen kielet: Finnish

Leikkaavuudet:

470611A	Metallurgy Processes	7.0 op

ECTS Credits:

5 cr / 135 hours of work

Language of instruction:

Available only in Finnish

Timing:

The course is given in the spring semester, during period IV. It is recommended to complete the course at the 1st spring semester

Learning outcomes:

Students passing the cource can name the most important solid inorganic materials (metals and compounds) and their applications. Students can describe the significance of the materials for the society and tell about the refining chains and environmental impacts of the materials. Students can describe the structure and properties of solid materials and their interdependency and characterization methods. Students can compare and classify materials and tell the factors the classification is based on. Additionally, students can tell about the importance of the structural approach on the materials when estimating their performance in use or in reprocessing.

Contents:

Sources, usage, importance, refining and environmental impacts of inorganic solid materials (metals and compounds) used in modern society. Structure, properties and interdependency between the structure and properties and material characterization methods. Application examples: solid materials as raw materials and products in process industry (e.g. steel and concrete).

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Lectures. Only in Finnish.

Target group:

Students of process engineering

Prerequisites and co-requisites:

No prerequisities.

Recommended optional programme components:

This course is an introduction to the advanced courses of metallurgy. Additionally, it gives a material-based perspective for the consideration of industrial processes. It is part of the education that aim at skills needed in the phenomenon-based modelling and planning of industrial processes as well as holistic understanding of industrial processes.

Recommended or required reading:

Material will be distributed during lectures. It is also available via courses www-site.

Assessment methods and criteria:

Written exam. Please note that the course is organised only in Finnish.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Pekka Tanskanen

Working life cooperation:

No

Other information:

-

A431126: Automation Technology, 25 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Module Preparing for the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Automation technology

477051A: Automation Engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477601A	Process Automation Systems	4.0 op

ECTS Credits:

5 ECTS /133 h of work

Language of instruction:

Finnish

Timing:

Autumn, period 1

Learning outcomes:

Students learn how to use PI diagrams, field instruments, automation systems and PLCs in design, implementation and commissioning projects. Students can configure and program the basic automation functions in DCSs and PLCs

Contents:

The operational and structural descriptions and concepts of process automation, automation commissioning projects, PI diagrams and field devices, configuration tools for automation functions, logic programming, telecommunication technology in automation, field buses, examples of commercial DCSs, PLCs and field bus systems

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures, demonstrations, configuration and logic programming exercises, excursion to a neighbouring industrial plant

Target group:

B.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

477011P Introduction to process and environmental engineering I and 448010P Introduction to process and environmental engineering II are recommended

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes and handouts, manuals/handbooks

Assessment methods and criteria:

Learning diary or examination

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Jukka Hiltunen and Aki Sorsa

Working life cooperation:

No

Other information:

-

477501A: Process dynamics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay477501A	Process Control Engineering I	5.0 op
470431A	Process Control Engineering I	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish/English. The main lecturing language is Finnish, but the course can also be taken in English with some special arrangements. Contact the responsible person.

Timing:

Negotiable (for the English version)

Learning outcomes:

After the course, the student understands the basic principles of dynamical behaviour of different processes, can write dynamic mass and energy balances for unit processes, and can solve these with the help of the transfer function approach. He knows also the connection between process control and process dynamics.

Contents:

Basics of process models and dynamics. Dynamic models. Lumped and distributed parameter models. Practical examples of different unit processes such as chemical reactors, distillation columns and heat exchangers. Modelling of large-scale processes.

Mode of delivery:

Negotiable (the course can be taken in English with some special arrangements - contact the responsible person)

Learning activities and teaching methods:

Solving exercise problems; textbook

Target group:

Exchange and other international students (for the English version)

Prerequisites and co-requisites:

Courses Material and Energy Balances, Heat Transfer, Mass Transfer and Control System Analysis recommended beforehand

Recommended optional programme components:

The course forms a basis to the advanced courses in the field of control engineering

Recommended or required reading:

Parts of the textbook used: Luyben, W.L.: Process Modeling, Simulation and Control for Chemical Engineers. McGraw Kogakusha Ltd., Tokyo 1973, 558 pp.

Assessment methods and criteria:

Homework and written/oral test

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Read more about assessment criteria at the University of Oulu webpage.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

-

477502A: Experiment design and analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Aki Sorsa

Opintokohteen kielet: Finnish

Leikkaavuudet:

470432A	Process Control Engineering II	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Implementation in the 4th period on the spring term

Learning outcomes:

After the course, the student knows different experimental design methods and their applicability for different problems. He can also design experiments for multi-variable processes and analyze the results. He can also use some basic means to visualize the results got from experimental data and choose proper tools for experiment design problems.

Contents:

Systematic design of process experiments with matrix techniques (Hadamard, Central Composite Design, Taguchi). Graphical and statistical analysis of experimental data. Correlation, regression and variance analysis. Dynamic data based modelling.

Mode of delivery:

Lectures and extensive exercise work

Learning activities and teaching methods:

Lectures during one period

Target group:

Bachelor’s students in process and environmental engineering

Prerequisites and co-requisites:

Course Process Dynamics is recommended beforehand

Recommended optional programme components:

The course forms a basis to the advanced courses in the field of control engineering

Recommended or required reading:

Reading materials. *Additional literature*: Diamond W.J.: Practical Experiment Designs. Lifetime Learning Publications. Belmont, California, 1981. 348 pp.

Assessment methods and criteria:

Examination. It is recommended to take the course also according to the principle of continuous evaluation.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Read more about assessment criteria at the University of Oulu webpage.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

For exchange/international students also the course 477041S Experimental Design is recommended

477621A: Control System Analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477602A	Control System Analysis	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish

Timing:

Period 1 (autumn term)

Learning outcomes:

After completing the course the student can describe the process dynamics with mathematical and graphical methods. The student can independently: form linear process models, analyse linear system stability, Bode diagrams, Routh’s stability criterion and the Jury's test, and evaluate the behavior of processes through time and frequency range specifications.

Contents:

Introduction to Matlab. Laplace-transforms. Transfer functions and block diagrams. Dynamical systems. Time and frequency analysis. System stability.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and exercises

Target group:

B.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

The courses 477011P Introduction to process and environmental engineering I, 488010P Introduction to process and environmental engineering II, and 477051A Automation engineering recommended beforehand

Recommended optional programme components:

None

Recommended or required reading:

Materials delivered at the lectures and exercises. Dorf, R. (2010) Modern Control System. 12th ed. Prentice-Hall. 1104 pp. Additional literature: Ogata, K. (2002) Modern Control Engineering. 4th ed. Prentice-Hall. 964 pp., DiStefano, J. (1990) Feedback and Control Systems. 2nd ed. Prentice-Hall. 512 pp.; Ylen; J-P. (1994) Säätötekniikan harjoitustehtäviä. Hakapaino Oy. 252 pp.

Assessment methods and criteria:

Exam and in addition extra points from homeworks

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Lecturer Jukka Hiltunen and university teacher Seppo Honkanen

Working life cooperation:

No

Other information:

-

477622A: Control System Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477603A	Control System Design	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish

Timing:

Period 3 (spring term)

Learning outcomes:

After completing the course the students can apply mathematical and graphical methods to the dynamics of process characterisation and control design. The student can form PID controllers for the process, and tune them and evaluate the closed-loop requirements.

Contents:

Laplace-level vs, time level, poles of the system, closed loop and its design specifications, PID control and tuning, Matlab control designer tool, control design in frequency domain

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and exercises

Target group:

B.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

The courses 477011P Introduction to process and environmental engineering I, 488010P Introduction to process and environmental engineering and 477602A Control system analysis recommended beforehand

Recommended optional programme components:

None

Recommended or required reading:

Lecture and exercise handouts. Åström, K & Murray, R. (2009) Feedback Systems, An Introduction for Scientists and Engineers. Princeton University Press, New Jersey, 396 s. Additional literature: Dorf, R (2010) Modern Control Systems. Prentice-Hall, New York, 1104 s., DiStefano, J (1990) Schaum's Outline of Feedback and Control Systems. 2nd ed, McGraw-Hill, 512 s. ja Ylen, J-P (1994) Säätötekniikan harjoitustehtäviä. Hakapaino Oy, 252 s.

Assessment methods and criteria:

Exam

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Professor Enso Ikonen and university teacher Seppo Honkanen

Working life cooperation:

No

Other information:

-

A431124: Working Life Studies, Process Engineering, 25 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic and Intermediate Studies
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Working life studies

555225P: Basics of industrial engineering and management, 5 op

Voimassaolo: 01.01.2014 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay555225P	Basics of industrial engineering and management (OPEN UNI)	5.0 op
555221P	Introduction to Production	2.0 op
555220P	Basic Course in Industrial Engineering and Management	3.0 op

Language of instruction:

Finnish. English material is also used.

Timing:

Periods 1-2.

Learning outcomes:

Upon completion of the course the student should be able to describe what operations management means. The student can explain the core concepts of business operations and utilize these concepts in describing and analyzing organizational operations. In addition, he/she can explain in general terms the factors that affect economic performance of organizations. The student is able to utilize the terminology used in operations management, describe the financial processes of companies and based on this describe the use of cost accounting in organizational decision-making. The student can also calculate unit costs in various simplified settings, calculate various alternatives, as well as perform planning and goal oriented calculations based on given data, and draw conclusions based on the calculation results.

Contents:

Operations and productivity, operations strategy, forecasting, cost accounting, investments, sustainability, capacity management, location decisions, layout strategies, human resources management, supply chain management, subcontracting, inventory management, production planning, MRP & ERP, production scheduling, Just-in-Time & Lean operations, maintenance.

Mode of delivery:

The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:

Web-based lectures 20 h / exercises 18 h / self-study 96 h.

Target group:

: Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:

No prerequisites exist.

Recommended optional programme components:

This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555285A Project management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

Recommended or required reading:

Lecture and exercise materials. Heizer, J. & Render, B. (2014) Operations management: sustainability and supply chain management, 11th ed. Pearson.

Assessment methods and criteria:

This course utilizes continuous assessment. During the course, there are nine mandatory weekly assignments. At least half of the assignments must be passed.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

D.Sc. Jukka Majava.

Working life cooperation:

No.

Other information:

Substitutes courses 555220P Basic Course in Industrial Engineering and Management 3 ECTS cr and 555221P Introduction to Production 2 ECTS cr.

555265P: Occupational Safety and Health Management, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Henri Jounila

Opintokohteen kielet: Finnish

Leikkaavuudet:

555263A	Technology, Society and Work	2.0 op
555260P	Basic Course in Occupational Safety and Wellbeing at Work	3.0 op

Required proficiency level:

ECTS Credits:

5,0 ECTS credits.

Language of instruction:

Finnish. English material is also used.

Timing:

Periods 3-4.

Learning outcomes:

After the course the student is capable of explaining basic terms of occupational safety and health. He/she is able to assess the importance of occupational safety, health and well-being at work. In addition, he/she is able to assess the significance of occupational safety in the improving of productivity and quality. He/she can apply different safety analysis. Upon completion of the course the student is familiar with the core issues of occupational safety and health management.

Contents:

Occupational safety and health, safety management, safety culture, laws and standards, hazards and risks, occupational diseases and work accidents, safety analysis, occupational safety at shared industrial work sites, occupational safety card, HSEQ-assessment procedure, other current issues.

Mode of delivery:

The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:

Lectures and assignments 26 h / group work 40 h / self-study 68 h.

Target group:

Industrial Engineering and Management, Mechanical Engineering, Process Engineering and Environmental Engineering students.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Lecture materials. Other materials will be defined during the course.

Assessment methods and criteria:

The grading is based on the exam (50 % of the grade) and exercises (50 % of the grade).

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Henri Jounila

Working life cooperation:

No.

Other information:

Substitutes courses 555260P Basic Course in Occupational Safety and Wellbeing at Work + 555263A Technology, Society and Work.

477004A: Practical Training, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Saara Luhtaanmäki

Opintokohteen kielet: Finnish

Leikkaavuudet:

488001A	Practical Training	3.0 op
477001A	Practical Training	3.0 op

ECTS Credits:

5 ECTS, 2 months working full-time

Language of instruction:

Finnish or English

Timing:

Student usually works during the summer time

Learning outcomes:

During the practical training students will acquaint themselves with working environments, preferably within their own study field, from the point of view of their studies and within one possible future job. They can identify problems associated with their working environment and can propose improvements to those. The students will experience what are the common features of working life and studies.

Contents:

-

Mode of delivery:

Working as an employee

Learning activities and teaching methods:

Students will find the training positions themselves. Suitable areas for practical training are, for example, the chemical industry, the pulp and paper industry, the metallurgical and mining industry, the biotechnological and food industry, and partly the electronics and automation industry.

Target group:

Bachelor’s students in Process and Environmental Engineering

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

-

Assessment methods and criteria:

Student has to present their original references and submit an application form and a training report to their tutor teacher. The reference must include the training period (from - to) and the duties.

Grading:

Verbal scale Passed/Failed

Person responsible:

Student councellor Saara Luhtaanmäki

Working life cooperation:

Yes

Other information:

The objective is to give an overview of the industrial area where the student may possibly work after graduation. Practical training nurtures theoretical study. In addition the training should give the student a general idea about the company and its technical and organizational operations, financial management and supervision. Student training positions often place students in employee-type positions so that the student becomes familiar with practical work, work safety, as well as with the social nature of the working environment. Students will land the jobs themselves.

900060A: Technical Communication, 2 op

Voimassaolo: 01.08.2005 - 31.07.2021

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Negotiated Education

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900060A	Technical Communication (OPEN UNI)	2.0 op
470218P	Written and Oral Communication	3.0 op

Proficiency level:

-

Status:

This course unit is compulsory for students of Electrical Engineering, Computer Science, Communications Technologies and Engineering Mechanical Engineering, Process and Environmental Engineering.

Required proficiency level:

-

ECTS Credits:

2 credits

Language of instruction:

Finnish

Timing:

Electrical Engineering, Computer Science and Engineering and Communications Technologies: 2nd year spring term or 3rd year autumn term or 3rd year spring term.
Mechanical Engineering: 3rd year.
Process and Environmental Engineering: 1 st year spring or autumn term.

Learning outcomes:

Upon completion of the course the student should be familiar with the central principles of work and study-related communication, both oral and written, and be able to apply this knowledge in his/her own communication. The student should be able to prepare and give an illustrative and understandable oral presentation on a topic related to his/her own field in a way that suits the audience and the situation. The student should also be able to seek information and report on his/her findings in writing. The student should be able to analyse and assess his/her own writing and the writing of his/her peers. He/she should be able to act in group communication situations in a target-oriented manner. The student should also be able to give and receive constructive criticism.

Contents:

Professional communication skills: team writing, the process of writing and its different stages, distinctive features of formal scientific and professional texts, oral communication, preparing an illustrative presentation, methods of convincing one's audience, giving and receiving constructive criticism, the features of a functioning team, the group process and the roles of team members, negotiations and meeting practices.

Mode of delivery:

Multimodal teaching

Learning activities and teaching methods:

Contact hours ca. 20 h and independent group work or self-study ca. 40 h.

Target group:

Bachelors students of Electrical Engineering, Computer Science, Communications Technologies and Engineering Mechanical Engineering, Process and Environmental Engineering.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Kauppinen, Anneli & Nummi, Jyrki & Savola, Tea: Tekniikan viestintä: kirjoittamisen ja puhumisen käsikirja (EDITA); Nykänen, Olli: Toimivaa tekstiä: Opas tekniikasta kirjoittaville (TEK) and material in Optima study environment.

Assessment methods and criteria:

Active participation in contact teaching, independent study and completion of given assignments.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Pass / fail

Person responsible:

Kaija Oikarainen
Toropainen, Outi

Working life cooperation:

-

Other information:

All students are required to attend the first meeting of the course unit so the work groups can be formed and work started in a timely and efficient manner. When signing up for the course unit, you should keep in mind that completing it requires a responsible attitude and a strong commitment to the work because the teamwork-based exercises rely heavily on the participation and activity of the students.
If the student is involved in the University's student associations or functions in a position of trust in university government, student union administration or Oulun Teekkariyhdistys ry (or in its subordinate guilds), he/she may be relieved of some of the group communication exercises. These compensatory actions must always be agreed upon separately with the course unit's teacher. The student must present an official statement from a person in charge of the governing body or association, which details the student's tasks and involvement with that body or association. Participation that took place over five years ago does not entitle the student to any compensation.

477990A: Bachelor's Thesis / Process Engineering, 8 op

Voimassaolo: 01.08.2007 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Saara Luhtaanmäki

Opintokohteen kielet: Finnish

Leikkaavuudet:

488990A	Bachelor's Thesis / Enviromental Engineering	8.0 op

Ei opintojaksokuvauksia.

H430495: Supplementary Studies, Process Engineering, 10 - 60 op

Voimassaolo: 01.01.2011 -

Opiskelumuoto: Other Entity

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

A431229: Module of the Option/Automation Engineering, 61 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Automation technology

477523S: Simulation, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

477503S	Simulation	3.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish and English

Timing:

Implementation in the 2nd autumn period. Recommended for fourth (1st M.Sc.) year students

Learning outcomes:

Upon completion the student is capable of explaining the concepts and operation principles for both simulators of continuous processes and event-based simulation. The student has skills to construct simulation models in Matlab-Simulink environment and to explain the operation of these models. The student recognizes the key problems of the simulation and is able to choose suitable modeling solutions in process modeling and control. Moreover, the student is able to use key concepts of interactive and distributed simulation. After the course the student is able to search other relevant simulation languages and programming tools

Contents:

Modelling, modular and equation based simulation, dynamic simulation, intelligent methods in simulation, simulation in automation, event handling in continuous simulation, simulation of production processes, distributed simulation, integration with other systems, simulation languages and programming tools

Mode of delivery:

Tuition is implemented mainly as face-to-face teaching

Learning activities and teaching methods:

The amount of guided teaching is 32 h, including lectures (16h), exercises (10h) and seminars (6h). Totally 58 h are allocated for self-study, which consists of three parts: (1) a case study covering several topics applied in a chosen problem, (2) a seminar work concentrating on a single topic, and (3) the final report.

Target group:

M.Sc. students in process and environmental engineering, machine engineering, computer engineering and industrial engineering and management

Prerequisites and co-requisites:

Matlab programming skills are a benefit; see "Recommended optional programme components" below

Recommended optional programme components:

Programming in Matlab course reinforces abilities for the exercises and the case study

Recommended or required reading:

Lecture notes and exercise materials. Material is in Finnish and in English.

Assessment methods and criteria:

The assessment of the course is based on learning diaries, exercises, case study, seminar and the final report. Final exam is an alternative for the final report.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:

D.Sc. (Tech.) Esko Juuso

Working life cooperation:

No

Other information:

-

477524S: Process Optimization, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay477524S	Process Optimization (OPEN UNI)	5.0 op
477504S	Process Optimization	4.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring semester, the 3th period. Recommended for 1st year M.Sc. students.

Learning outcomes:

Student can use and apply standard unconstrained and constrained optimization methods. Student can define and identify optimization problems. Student is able to summarize the role of optimization in process engineering.

Contents:

Basic concepts of optimization. Optimization of unconstrained and constrained functions. Linear programming. Trajectory optimization. Hierarchical optimization. Intelligent methods in optimization. Applications in process engineering.

Mode of delivery:

Face-to-face teaching and exercises as group work

Learning activities and teaching methods:

The amount of guided teaching is 40 hrs. Contact teaching includes, depending on situation, lectures, group work and tutored group work. During self-study time student does independent or group work.

Target group:

M.Sc. students of process and environmental engineering and M.Sc. students interested in process optimization. Exchange and other international students.

Prerequisites and co-requisites:

No prerequisites but basic understanding on numerical methods and process modelling are useful.

Recommended optional programme components:

See prerequisites

Recommended or required reading:

Reading materials. Ray, W.H. & Szekely, J. (1973) Process Optimization with Applications in Metallurgy and Chemical Engineering. John Wiley & Sons.

Assessment methods and criteria:

This course uses continuous assessment that includes solved exercises and lecture exams. Final exam is also possible.

Grading:

The course unit uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

-

477623S: Process Information Systems, 10 op

Voimassaolo: 01.08.2015 - 31.07.2021

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hiltunen, Jukka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

477610S	Process Information Systems	5.0 op
477606S	Fault Diagnosis and Process Performance Analysis	2.0 op

ECTS Credits:

10 ECTS / 266 hours of work

Language of instruction:

Finnish

Timing:

Periods 3-4 (spring term)

Learning outcomes:

After completing the course the student can implement performance-enhancing and maintenance systems, and plan, evaluate and develop also other large scale automation and information systems.

Contents:

Model- and data-based diagnostic methods. Measurement validation. Process performance assessment and follow-up. Application examples. Industrial Internet: Purpose of information systems. Technologies used in wide information systems. Case study analyses.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Seminars. The course is given every second year during two periods.

Target group:

M.Sc. students of process and environmental engineering

Prerequisites and co-requisites:

The course 477051A Automation Engineering recommended beforehand

Recommended optional programme components:

-

Recommended or required reading:

Will be announced later

Assessment methods and criteria:

Learning diary, seminars and exam

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Lecturer Jukka Hiltunen

Working life cooperation:

No

Other information:

-

477624S: Control System Methods, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477614S	Control System Methods	3.0 op
477605S	Digital Control Theory	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish

Timing:

Period 1 (autumn term)

Learning outcomes:

After completing the course students can identify the problems of the sampled data systems, and know how to apply discrete time methods for systems analysis and control design.

Contents:

1. Control systems design by frequency-response methods. 2. Control systems design in state space methods 3. Sampled data systems: sampling, Z transformation of signals. 4. Discrete-time modelling: difference equation, shift operator, pulse transfer function, polynomial and state-space description. 5. Analysis of discrete-time systems: z-plane, stability. 6. Discrete-time control design strategies: general RST structure, various pole-zero placement control algorithms, minimum-variance control, model-based control, state-space design methods.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and exercises include guided computer simulations

Target group:

M.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

The courses 477602A Control system analysis and 477603A Control system design recommended beforehand

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout. Dorf, R. (2010) Modern Control Systems. Prentice-Hall, New York, 1104 s, Ogata, K (2002) Modern Control Engineering. Prentice-Hall, New York, 964 s., Åström, K & Murray, R. (2009) Feedback Systems, An Introduction for Scientists and Engineers. Princeton University Press, New Jersey, 396 s., Landau, I. & Zito, G. (2005) Digital Control Systems, Springer. 485 pp. Åström, K.J. & Wittenmark, B. (1984, 1997) Computer Controlled Systems: Theory and Design. Prentice-Hall International. 544 pp.

Assessment methods and criteria:

Final written exam; to request an exam in English, contact the lecturer via email beforehand.

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

University teacher Seppo Honkanen

Working life cooperation:

No

Other information:

-

477607S: Advanced Control and Systems Engineering, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ikonen, Mika Enso-Veitikka

Opintokohteen kielet: Finnish

Leikkaavuudet:

470444S	Advanced Control Methods	6.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish (English if necessary)

Timing:

Period 3 (spring term)

Learning outcomes:

After completing the course the student can design the model based control systems, can formulate and solve state estimation problems, and discover research trends in control and systems engineering

Contents:

1. Model-based control: as DMC, QDMC; GPC. 2. State estimations: as Kalman filtering and particle filters. 3. Active research directions (elected annually)

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and demonstration exercises

Target group:

M.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

The courses 477602A Control system analysis, 477603A Control system design, 4776xxS Control system methods, 477605S Digital control theory recommended beforehand

Recommended optional programme components:

None

Recommended or required reading:

Materials distirbuted during the contact teaching and through the course web pages

Assessment methods and criteria:

Exam and homework
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1.5 or fail

Person responsible:

Professor Enso Ikonen

Working life cooperation:

No

Other information:

-

477525S: Computational intelligence in automation, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477505S	Fuzzy-neuromethods in Process Automation	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish and English

Timing:

Implementation in the autumn term, on hte 2nd period. Recommended for fourth year students (first M.Sc. year)

Learning outcomes:

After the course the student is capable of explaining the concepts of intelligent systems and operation principles of fuzzy set systems, neural networks, neuro-fuzzy systems and evolutionary computation. The student has skills to construct and tune fuzzy models in Matlab-Simulink environment and to explain the operation of these models. The student is able to explain in an integrating way the principle concepts of neural computing and construct neural network models in Matlab-Simulink environment. The student recognizes the key problems of the data-driven modelling and is able to choose suitable solutions which ensure generalization. The student is able to explain the operation principles of genetic algorithms and to use them in tuning of fuzzy set systems and neural network models. Moreover, the student is able to describe alternative solutions for dynamic models, hyperplane methods and hybrid solutions. The student can explain the key concepts of cellular automata and evolutionary computation. After the course the student is able to search other relevant programming tools.

Contents:

Fuzzy logic and fuzzy set systems, fuzzy calculus, fuzzy modeling and control, neural computation, learning algorithms, neuro-fuzzy methods, linguistic equations, evolutionary computation, hyperplane methods, cellular automata, intelligent diagnostics and decision making, adaptive intelligent systems, hybrid systems.

Mode of delivery:

Tuition is implemented mainly as face-to-face teaching.

Learning activities and teaching methods:

The amount of guided teaching is 32 hrs, including lectures (16), exercises (10) and seminars 6). Totally 58 hrs are allocated for self-study, which consists of three parts: (1) a case study covering several topics applied in a chosen problem, (2) a seminar work concentrating on a single topic, and (3) the final report.

Target group:

M.Sc. students in process and environmental engineering, machine engineering, computer engineering and industrial engineering and management.

Prerequisites and co-requisites:

No specific prerequisites, but skills for simulation, and programming in Matlab are a benefit. See "Recommended optional programme components" below.

Recommended optional programme components:

Courses Simulation, and Programming in Matlab reinforce abilities for the exercises and the case study

Recommended or required reading:

Lecture notes and exercise materials. Material is in Finnish and in English.

Assessment methods and criteria:

The assessment of the course is based on the exercises, case study, seminar and the final report. Final exam is an alternative for the final report.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

D.Sc. (Tech.) Esko Juuso

Working life cooperation:

No

Other information:

-

Choose 5 courses

031080A: Signal Analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Kotila, Vesa Iisakki

Opintokohteen kielet: Finnish

Leikkaavuudet:

031050A	Signal Analysis	4.0 op

Ei opintojaksokuvauksia.

477506S: Modelling and Control of Biotechnical Processes, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Leiviskä, Kauko Johannes
Opintokohteen kielet: English
Leikkaavuudet:

480452S	Bioprocess Modelling and Control	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Implementation in the 1st period (autumn term)

Learning outcomes:

After the course, the student can model kinetics and dynamics of bio-technical processes (mainly fermentation) starting from the process phenomena and mass balance models. He also understands the limitations of different approaches and the modelling assumptions. He also has preliminary skills to write models in Matlab/Simulink environment.

Contents:

Bioreactors: models, kinetics and transfer phenomena. Models: different modelling approaches with examples. Control of fermentation processes.

Mode of delivery:

Contact lectures, individual work and home tests (one per week)

Learning activities and teaching methods:

The course is given within the period of five weeks. Laboratory exercises include computational exercises and writing the report.

Target group:

Master’s students in Process and Environmental Engineering /Automation Technology

Prerequisites and co-requisites:

Course Process Control Engineering I or respective recommended beforehand

Recommended optional programme components:

-

Recommended or required reading:

Lecture material*s.*
Additional literature: Schügerl, B. (ed.): Bioreaction Engineering. Springer Verlag, 2000. pp. 21-43.; Sonnleitner, B.: Instrumentation of Biotechnical. In: Advances in Biochemical Engineering 66. Springer 2000; Jeongseok, L. et al.: Control of Fed-batch Fermentations. Biotechnology Advances 17 (1999) 29-4817 (1999) 29-48; Rani, K.Y. & Rao, V.S.R.: Control of Fermenters - a Review. Bioprocess Engineering 21 (1999) 77-8821 (1999) 77-88
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Assessment methods and criteria:

Grade given is based on home tests and exercise report; ratio is 4/1. Final examination is also possible. Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä, Dr Aki Sorsa

Working life cooperation:

No

Other information:

-

477507S: Automation in Pulp and Paper Industry, 5 op

Voimassaolo: 01.08.2005 - 31.07.2021

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: English

Leikkaavuudet:

470338S	Process Control in Pulp and Paper Industry	3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

No set schedule. Contact the responsible person.

Learning outcomes:

After the course, the student knows the management and control problems in pulp and paper industry and can choose between the main means to solve them. He knows also the need and practice of special measurements on this area. He can apply the skills of earlier studies in analysing the control of separate processes and larger process lines and can estimate technical and economic effects of automation in pulp and paper industry.

Contents:

Control systems and methods, special measurements, automation in pulp industry (fibres, chemicals, mechanical pulping, paper machines, mill-wide automation), process analysis, modelling, and simulation. Application of intelligent methods in paper industry.

Mode of delivery:

Individual work (self-study/group work); no lectures given

Learning activities and teaching methods:

The course includes a literature review of a given topic done in groups of 2-3 students and a written test from the book given below. The course can be taken any time regardless of teaching periods.

Target group:

Master’s students in study programmes Process or Environmental Engineering /study option Automation Technology. Exchange and other international students of the field.

Prerequisites and co-requisites:

Course Pulp and Paper Technology recommended beforehand

Recommended optional programme components:

-

Recommended or required reading:

Leiviskä, K.: Process Control. Book 14. Papermaking Science and Technology Series. Fapet Oy 1999.

Assessment methods and criteria:

Book examination, literature report.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

-

477508S: Automation in Metallurgical Industry, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Implementation in the 4th period (spring term)

Learning outcomes:

After the course, the student knows the management and control problems in metallurgical industry and can choose between the main modelling and control methods to solve them. He can apply the skills of earlier studies in analysing the control of separate processes and larger process lines and can estimate technical and economic effects of automation in metallurgical industry.

Contents:

Modelling and control examples of steel production processes: coking, sintering, blast furnace, steel converter, continuous casting, and rolling mill. Model solutions by special-purpose simulators. Also some special measurements are introduced.

Mode of delivery:

Lectures, practical group work using simulators

Learning activities and teaching methods:

Lectures during one period

Target group:

Master's students in the study programmes of Process or Environmental Engineering/study option Automation Technology. Exchange and other international students.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes in English. Everyone does his/her material during the course in the form of lecture diary that is returned and evaluated at the end. Group work uses the simulator in the Internet.

Assessment methods and criteria:

Continuous evaluation: lectures, lecture diaries, test, and practical work using simulation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

-

477625S: Power Plant Automation, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477611S	Power Plant Automation	2.0 op
477612S	Power Plant Control	3.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish

Timing:

Period 4 (spring term)

Learning outcomes:

The student has a full understanding of the role of the power plants in energy market and the importance of different energy sources. The student will understand the structure of different power plants, the main components and can explain their behavior and operation. The role and manner of measurements will be clarified. Furthermore, the student will understand the main principles in modelling energy systems. The student will fully understand the static and dynamic behaviour of the power plants and the sub processes. The student will understand the role of control in power plant operation and can describe the main principles and structures of control systems. The student can implement the theoretical knowledge gained in power plant automation courses into practice and has deepened his/her understanding in the subject. The student knows the principles of power plant operation in different situations (start-ups and shut-downs, load changes).

Contents:

Introduction to energy market and consumption. Description of different types of power plants and the main components and their operation. Fundamentals of industrial measurements, sensors, emissions and industrial actuators. Static and dynamic modelling of power plants. . The control principles and the main control loops. Comparison of different control solutions. 3 x 4h simulation exercises in small groups (2-4 persons) with a MetsoDNA power plant simulator.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures, exercises and industrial visit. Final exam.

Target group:

M.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

No

Recommended optional programme components:

The course is followed by course 477612S Power Plant Control

Recommended or required reading:

Lecture hand-out and Joronen,T., Kovács J. & Majanne Y. (2007) Voimalaitosautomaatio. Suomen automaatioseura Oy. 276 pp.

Assessment methods and criteria:

Exam

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Docent Jenö Kovács, Ph. D. student Laura Niva and lecturer Tero Hietanen (OAMK, Oulu University of Applied Sciences)

Working life cooperation:

No

Other information:

-

477713S: Automation in Mineral Processing, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: Finnish

Leikkaavuudet:

477510S	Automation in Mineral Processing	5.0 op
477724S	Numerical Mine Modelling	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Implementation in the 4th period (spring term)

Learning outcomes:

The target is to give the students the skills to understand and develop models for minerals processing and apply these models in process monitoring and control.

Contents:

Models for processes like crushing, grinding, flotation, leaching, separation etc. Examples how to use these models in process control and what kind of benefits can be drawn from their use.

Mode of delivery:

Lectures and demonstrations

Learning activities and teaching methods:

Lectures during one period

Target group:

Master's students in process and environmental engineering. Exchange students.

Prerequisites and co-requisites:

Basic knowledge in minerals processing and control engineering

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes in English

Assessment methods and criteria:

Continuous evaluation: lectures and test

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

-

H431230: Module of the Option/Bioproducts and Bioprocess Engineering, 60 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Alternative

A431230: Module of the Option/Bioproducts and Bioprocess Engineering, Bioproducts Technology, 31 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

477123S: Chemical processing of biomasses, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477104S Chemical Pulping 3.0 op

ECTS Credits:

5 ECTS /133 h of work

Language of instruction:

English

Timing:

Implementation in autumn period 1

Learning outcomes:

Upon completion of the course, a student should be able to explain the value chain of chemical processing of renewable lignocellulosic raw materials to pulp and different end-products. A student is able to indentify lignocellulosic raw material sources, their properties, their main components and utilization potential of components. The student also indentifies the unit operations of chemical pulping processes, can explain their operational principles and their objectives in the process and their role in end product properties. Besides cellulose fibre production, the student identifies biorefining concepts of chemical pulp components (cellulose, hemicelluloses, lignin and extractives) into high value products; cellulose derivatives, special fibres, nanofibrillar and micronized celluloses, and green chemicals.

Contents:

Lignocellulosic raw materials, fundamentals of chemical pulping, recovering of chemicals in kraft pulping, bleaching of pulp. High value biomass products by biorefining (e.g. nanocelluloses and soluble celluloses).

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

The implementation methods of the course vary. Lectures and exercises 32 h, web learning 64 h, and self-study 37 h. A part of teaching can be replaced by group works or home works.

Target group:

Students interested in bioeconomy

Prerequisites and co-requisites:

488052A Introduction to Bioproduct and Bioprocess Engineering is recommended.

Recommended optional programme components:

-

Recommended or required reading:

Book series: Fapet Oy. Papermaking Science and Technology, book 6: Chemical pulping Part 1 and Part 2, book 20: Biorefining of Forest Resources. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:

This course utilizes continuous assessment including lecture diarys, self tests during web learning and three intermediate exams. Alternatively, the course can also be completed by taking the end exam. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Ari Ämmälä

Working life cooperation:

No

Other information:

-

477124S: Mechanical processing of biomasses, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477105S	Mechanical Pulping	3.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

English

Timing:

Implementation in autumn period 2

Learning outcomes:

Upon completion of the course, a student should be able to explain the value chain of mechanical and chemimechmical processing of renewable lignocellulosic raw materials. Upon completion of the course, a student should be able to identify the unit operations of mechanical and chemi-mechanical pulping process and can explain their operational principles. The student can evaluate the raw material properties and importance of different unit processes on the quality of the end products. In addition, the student can compare fibre properties of different mechanical and chemi-mechanical pulps and wood powders and can explain their effects on the quality of the end product. Student can explain production principle of engineered wood, biocomposites and pelletizing.

Contents:

Processing of wood, mechanical fibres, wood powders: raw material properties, mechanical and chemimechanical defibering, screening, bleaching, biomass micronization and pulverization, the production of engineered wood, wood-plastic composites and pellets. End product properties.

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

The implementation methods of the course vary. Lectures and exercises 32 h, web learning 64 h, and self-study 37 h. A part of teaching can be replaced by group works or home works.

Target group:

Students interested in bioeconomy

Prerequisites and co-requisites:

488052A Introduction to Bioproduct and Bioprocess Engineering is recommended

Recommended optional programme components:

-

Recommended or required reading:

Book series: Fapet Oy. Papermaking Science and Technology, book 5: Mechanical Pulping. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:

This course utilizes continuous assessment including lecture diarys, self tests during web learning and three intermediate exams. Alternatively, the course can also be completed by taking the end exam. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

This course utilizes continuous assessment including lecture diarys, self tests during web learning and three intermediate exams. Alternatively, the course can also be completed by taking the end exam.

Person responsible:

Ari Ämmälä

Working life cooperation:

No

Other information:

-

477125S: Recycling of bioproducts, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477128S	Circular Bioeconomy	5.0 op
477106S	Recycled Fiber Processes	3.0 op
477105S	Mechanical Pulping	3.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

English

Timing:

Implementation in the spring period 3

Learning outcomes:

Upon completion of the course, a student should be able to recognize the incentives for the recycling of bioproducts and waste streams from bioproduct industry. Student identifies collection and recovering systems, recovered material properties and their impact on processing, principles unit processes and processing with respect to final product requirement. A student should be able to identify the unit operations of required processing and explain their key operational principles and also the function of the most important chemicals. A student can also perceive the importance of life-cycle assessment and recyclability properties design in both R&D and production stages of bioproducts, including the significance of bioenergy production as a part of bioproduct recycling.

Contents:

Reuse, recycling and energy utilization of bioproduct and side streams of bioproduct industry in accordance with waste hierarchy. Analysis procedures to assess raw material utilization potential. Process concepts and unit processes in recycling and reusing of bioproducts including wood products, paper and board products, biocomposites and side streams. The utilization and final disposal of residuals from bioenergy production.

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

The implementation methods of the course vary. Lectures and exercises 32 h, web learning 64 h, and self-study 37 h. A part of teaching can be replaced by group works or home works.

Target group:

Students interested in bioeconomy

Prerequisites and co-requisites:

488052A Introduction to Bioproduct and Bioprocess Engineering is recommended

Recommended optional programme components:

-

Recommended or required reading:

Book series: Fapet Oy. Papermaking Science and Technology, book 7: Recycled Fiber and Deinking. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:

This course utilizes continuous assessment including lecture diarys, self tests during web learning and three intermediate exams. Alternatively, the course can also be completed by taking the end exam. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Ari Ämmälä

Working life cooperation:

No

Other information:

-

477126S: Manufacturing of fibre products, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477107S	Paper Manufacture	3.0 op
477106S	Recycled Fiber Processes	3.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

Finnish. Possible to complete also in English as a book examination.

Timing:

Implementation in spring period 4

Learning outcomes:

Upon completion of the course, a student should be able to identify the unit operations paper and board manufacturing and can explain their purpose of use. The student can name the most important chemicals, fillers and coating pigments and can explain their importance in paper and board making. The student can present the essential properties of papermaking fibres, the structure and properties of paper and board, as well as different paper and board grades. The student knows the fundamentals of printing technology and indentifies paper properties essential for printing.

Contents:

Properties of fibers, web forming, chemicals in paper manufacture, coating process, structure and properties of paper, paper processing, paper grades, and fundamentals of printing technology.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and case studies, excursion to paper mills and printing laboratory.

Target group:

Students interested in bioeconomy

Prerequisites and co-requisites:

488052A Introduction to Bioproduct and Bioprocess Engineering is recommended

Recommended optional programme components:

-

Recommended or required reading:

Book series: Fapet Oy. Papermaking Science and Technology, books 8-11, and 13. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:

Exam and case studies. Book exam in English is possible for foreign students. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Timo Jortama, Ari Ämmälä

Working life cooperation:

No

Other information:

-

477127S: Research training of bioproduct technology, 10 op

Voimassaolo: 01.08.2015 - 31.07.2021

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477133S	Research training of bio and circular economy	5.0 op
477131S	Characterisation of biobased materials	5.0 op
477130S	Research training of bio and circular economy	10.0 op
477113S	Research Training of Pulp and Paper Technology	10.0 op

ECTS Credits:

10 ECTS / 266 hours of work

Language of instruction:

English. Possible to complete also in Finnish.

Timing:

Implementation during autumn periods 1-2

Learning outcomes:

Upon completion of the course, a student can design, carry out and report an experimental research project.

Contents:

Using of literature, making focused experimental plans, the execution of laboratory and/or pilot scale experiments, data processing and reporting, and writing a scientific paper.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Research project is executed under a supervision of research scientists. A student reports project results in the form of scientific paper and oral presentation.

Target group:

Students interested in bioeconomy

Prerequisites and co-requisites:

Studies in the field of bioproduct technology are recommended

Recommended optional programme components:

-

Recommended or required reading:

Materials given by a supervisor

Assessment methods and criteria:

Evaluaton of student's working skills, evaluation of research report, and evaluation of oral presentation. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Ari Ämmälä

Working life cooperation:

Yes. During the course a student works as a member of the research group. The research work consists of hands-on working with laboratory equipment and analysis devices.

Other information:

-

A431231: Module of the Option/Bioproducts and Bioprocess Engineering, Bioprocess Engineering, 59 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compolsory: Prerequisites for this module are following courses: 488301A Mikrobiologia (5 ECTS), and 488302A Basics of bBiotechnology (5 ECTS).

488321S: Bioreactor technology, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488304S	Bioreactor Technology	6.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course is held in autumn semester during period 2. It is recommended to complete the course in the 4th (1st Master's) year.

Learning outcomes:

After completing this course, the student will be able to verbally describe the most common equipment, materials and methods related to biotechnological processes, microbial growth and cultivation and sterilization. The student will be able to apply different mathematical formulas for biocatalysis and for the bioreactor performance and use those to plan and analyze bioprocesses. The student will also be able to produce, analyze and interpret data from bioprocesses.

Contents:

Biotechnological process: General process schemes, batch, fed-batch and continuous processes, biocatalysts and raw materials. Reactor design and instrumentation. Sterilization: kinetics of heat inactivation and practical implementation of sterilization methods. Mathematical description and quantification of the function of biocatalysts. Monod and Micahelis-Menten models, reaction rates and their determination. The lag phase of growth, cellular maintenance, cell death. Kinetics of product and by-product formation. Kinetics of oxygen and heat transfer. Oxygen and heat balances: significance and calculations. Power consumption. Scale-up and scale-down.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures 50 h / exercises 8 h / homework 16 h / self-study 59 h.

Target group:

Master students in bioprocess engineering. Master students in process engineering, environmental engineering and biochemistry with required prerequisites.

Prerequisites and co-requisites:

The previous bachelor level courses in Process or Environmental Engineering (especially 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering) or respective knowledge.

Recommended optional programme components:

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Recommended or required reading:

Lectures: Lecture hand outs; Doran, P. M. Bioprocess engineering principles. Academic Press. London, 2010. Supplementary material: Villadsen J., Nielsen J., Liden G. Bioreactor engineering principles. Springer Verlag, 2011.

Assessment methods and criteria:

Lectures, exercises, final exam, homework. Grade will be composed of final exam, exercises and homework.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Johanna Panula-Perälä

Working life cooperation:

No

Other information:

-

488305S: Advanced Course for Biotechnology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Sanna Taskila

Opintokohteen kielet: English

Leikkaavuudet:

480450S	Bioprocesses III	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course is held in spring semester during period 3. It is recommended to complete the course in the 4th (1st Master's) year.

Learning outcomes:

After completing this course, the student will be able to describe the most important techniques - both up- and downstream - in biotechnological production of proteins and metabolites.

Contents:

Microbial homologous and heterologous protein production. Physiological and process related items in the production of selected microbial metabolites. Principles and practices in metabolic engineering. Methods for process intensification. Scale-up of bioprocesses. Unit operations in product recovery and purification.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures 36 h / homework 48 h / self-study 49 h.

Target group:

Master students in bioprocess engineering. Master students in process engineering, environmantal engineering and biochemistry with required prerequisites.

Prerequisites and co-requisites:

Courses 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering and 488304S Bioreactor technology, or respective knowledge.

Recommended optional programme components:

-

Recommended or required reading:

Will be announced at the lectures.

Assessment methods and criteria:

Lectures and final examination, exercises and the report. Grade will be composed of homework exercises and reports or final examination. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr. Sanna Taskila

Working life cooperation:

No

Other information:

-

488311S: Industrial Microbiology, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Sanna Taskila

Opintokohteen kielet: English

Leikkaavuudet:

488310S	Laboratory Course in Microbiology	2.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course is held as intensive course in autumn semester during period 2

Learning outcomes:

After completing this course, the student will be able to operate in a microbiological laboratory. The student will be able to handle and cultivate microbes, follow the growth of microbes, and to apply these methods to different microbes. Student will be able to write a laboratory diary.
The student will be able to plan and conduct bench-scale research on biotechnical processes using aseptic techniques, and to evaluate and report the results of her/his research. The student will learn to apply microbes for the production of relevant biochemicals, to conduct analyses and mathematically examine the performance of studied production systems, to evaluate the challenges in up-scaling of the system, and to compare the results of research to existing literature.

Contents:

The topic of the course is related to current topics in biotechnology. The work will include laboratory exercises in the area of biocatalysis under supervision of researchers and a written final report including results of laboratory work. An industry excursion related to the course topic is arranged in Oulu area when possible.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 2 h/ laboratory exercises 70 h/ written report 35 h / self-study 26 h.

Target group:

Master's students of bioprocess engineering.

Prerequisites and co-requisites:

Courses 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering, 488304S Bioreactor technology, or respective knowledge.

Recommended optional programme components:

-

Recommended or required reading:

Working instructions; current publications and textbooks etc. on microbiology, biotechnology and environmental engineering.

Assessment methods and criteria:

Grade will be composed of supervised practical laboratory exercises, written report, literature search, and seminar. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr. Sanna Taskila, University teacher Johanna Panula-Perälä

Working life cooperation:

No

Other information:

-

488322S: Bioprocess Engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

488307S	Bioprocess Engineering	7.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course is given in spring semester during period 4. It is recommended to complete the course in the 4th year.

Learning outcomes:

In this course students will learn key methods of microbial production (e.g. fermentation, protein production and purification). Practice in research project planning, in different methods for biotechnology, and in report writing and seminar presentation will train the student for conducting a scientific research project.
After completing this course, the student will be able, under supervision, to prepare a research plan for his/her practical laboratory training research project. The student will be able to apply different biotechnological methods used in the recombinant protein production, in fermentation processes and in protein purification. He/she will be able to analyze the research results and to present them both in written and oral form.

Contents:

A student will be personally supervised by researchers during three weeks laboratory practicum. In the end of the practicum, the student will provide an extended written report, including a literature study and the practical results. The student will also practice a scientific seminar presentation. Subjects are changed annually.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 2 h / Laboratory exercises 70 h / written report 30 h / literature research and seminar 30 h

Target group:

Master students in the study option bioprocess engineering

Prerequisites and co-requisites:

Courses 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering, 488311S Industrial microbiology, 488304S Bioreactor technology, 488305S Advanced Course for Biotechnology, or respective knowledge

Recommended optional programme components:

-

Recommended or required reading:

Working instructions; current publications and textbooks on bioprocess engineering, microbiology and biotechnology depending on the annual subject. Other material announced at the lectures.

Assessment methods and criteria:

Grade will be composed of supervised practical laboratory exercises, written report, literature search, and seminar. Course is primarily meant for the students of bioprocess engineering study option.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Johanna Panula-Perälä

Working life cooperation:

No

Other information:

Detailed schedule of the course is informed in the starting lecture

740148P: Biomolecules, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Faculty of Biochemistry and Molecular Medicine

Arvostelu: 1 - 5, pass, fail

Opettajat: Tuomo Glumoff

Opintokohteen kielet: English

Leikkaavuudet:

ay740157P	Basic biochemistry 1: Biomolecules (OPEN UNI)	4.0 op
ay740152P	Basic biochemistry 1: Biomolecules (OPEN UNI)	5.0 op
740143P	Biomolecules for Biochemists	8.0 op
740147P	Biomolecules for Bioscientists	8.0 op

ECTS Credits:

5 credits

Language of instruction:

English

Timing:

autumn-spring

Learning outcomes:

Upon successful completion students are able to:

- tell the composition, structure and function of the major groups of biomolecules in cells; nucleic acids, proteins, carbohydrates and lipds and describe the forces that modulate their function.
- apply information in the right context and evaluate it critically

Contents:

This module provides an overview of biochemistry, outlining the forces involved in biomolecule structure and the chemical structures and properties of polynucleic acids, proteins, carbohydrates and lipids. There will also be an introduction to prebiotic evolution and a student debate on this subject. The module is arranged into lectures, workshops, a student debate. All of the exercises are in English. Both a final examination and continuous assessment will count towards the final mark and attendance of some parts is compulsory.

Mode of delivery:

Face to face teaching

Learning activities and teaching methods:

30 h lectures, plus exercises

Target group:

Minor subject students

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Mathews, van Holde & Ahern: Biochemistry, (3rd edition) , published by Addison Wesley Longman, Inc. or equivalent

Assessment methods and criteria:

Continuous assessment, final examination
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5/fail

Person responsible:

Tuomo Glumoff

Working life cooperation:

No

Other information:

This module is the same as Biomolecules for Biochemists except that it contains no practical component. Location of instruction: Linnanmaa campus

740149P: Metabolism I, 4 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Faculty of Biochemistry and Molecular Medicine

Arvostelu: 1 - 5, pass, fail

Opettajat: Tuomo Glumoff

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay740158P	Basic biochemistry 3: Metabolis (OPEN UNI)	4.0 op
ay740154P	Basic biochemistry 3: Metabolis (OPEN UNI)	3.0 op
740146P	Metabolism I	6.0 op

ECTS Credits:

4 credits

Language of instruction:

Finnish

Timing:

spring

Learning outcomes:

Students will be able to explain the main principles of how the metabolism is made up, will get a detailed picture of the energy metabolism, and will be able to organize part of the wholeness of metabolism, particularly how energy metabolism is networked to the synthesis and degradation of biomolecules.

Contents:

On this course the central concepts and mechanisms of metabolism, its regulation and the integration of metabolic pathways will be introduced, like anabolism and catabolism, linking of different pathways, and metabolic regulation. Especially the energy metabolism will be studied, concerning carbohydrates, lipids and the respiratory chain. Combined with the course Metabolism II the students will get a good overview on the principles of metabolism, metabolic integration and the methods to study metabolism.

Mode of delivery:

Face to face teaching

Learning activities and teaching methods:

Lectures (28 h), problem-based exercises (workshops) 6 h and final exam.

Target group:

Minor subject students

Prerequisites and co-requisites:

Biomolecules for Biochemists or Biomolecules for Bioscientists or Biomolecules

Recommended optional programme components:

-

Recommended or required reading:

-

Assessment methods and criteria:

Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5/fail. Problem-based exercises and a final exam will count towards the final grade.

Person responsible:

Tuomo Glumoff

Working life cooperation:

-

Other information:

This module is the same as Metabolism I (740146P), except that it contains no laboratory component.
Location of instruction: Linnanmaa

477506S: Modelling and Control of Biotechnical Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: English

Leikkaavuudet:

480452S	Bioprocess Modelling and Control	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Implementation in the 1st period (autumn term)

Learning outcomes:

After the course, the student can model kinetics and dynamics of bio-technical processes (mainly fermentation) starting from the process phenomena and mass balance models. He also understands the limitations of different approaches and the modelling assumptions. He also has preliminary skills to write models in Matlab/Simulink environment.

Contents:

Bioreactors: models, kinetics and transfer phenomena. Models: different modelling approaches with examples. Control of fermentation processes.

Mode of delivery:

Contact lectures, individual work and home tests (one per week)

Learning activities and teaching methods:

The course is given within the period of five weeks. Laboratory exercises include computational exercises and writing the report.

Target group:

Master's students in Process and Environmental Engineering /Automation Technology

Prerequisites and co-requisites:

Course Process Control Engineering I or respective recommended beforehand

Recommended optional programme components:

-

Recommended or required reading:

Lecture material*s.*
Additional literature: Schügerl, B. (ed.): Bioreaction Engineering. Springer Verlag, 2000. pp. 21-43.; Sonnleitner, B.: Instrumentation of Biotechnical. In: Advances in Biochemical Engineering 66. Springer 2000; Jeongseok, L. et al.: Control of Fed-batch Fermentations. Biotechnology Advances 17 (1999) 29-4817 (1999) 29-48; Rani, K.Y. & Rao, V.S.R.: Control of Fermenters - a Review. Bioprocess Engineering 21 (1999) 77-8821 (1999) 77-88
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Assessment methods and criteria:

Grade given is based on home tests and exercise report; ratio is 4/1. Final examination is also possible.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä, Dr Aki Sorsa

Working life cooperation:

No

Other information:

-

477204S: Chemical Engineering Thermodynamics, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Period 1 (autumn term)

Learning outcomes:

By completing the course the student understands classical thermodynamics from a chemical engineering viewpoint. Especially she/he can explain the pVT behaviour of pure substances and understands the thermodynamic properties of mixtures. The student can classify the thermodynamic models describing, for example, liquid mixtures or electrolytes. The student can select appropriate models for gas, vapour and liquid phases. In addition, the student can solve process models, phase equilibrium and chemical reaction equilibrium problems, and more generally, is able to evaluate chemical processes using thermodynamic analysis tools.

Contents:

Mass and energy balances, pVT behaviour of pure substances, thermodynamic properties of fluids, thermodynamics of electrolytes, chemical reaction equilibrium, vapour/liquid equilibrium, calculation of thermodynamical state functions, thermodynamic analysis of processes.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 34h and self-study 99h

Target group:

Students in the study options Process Design and Chemical Engineering

Prerequisites and co-requisites:

Thermodynamic equilibria

Recommended optional programme components:

Part of the Process Design Module

Recommended or required reading:

Lecture handout. Material given during the lectures. Additional literature, Smith, J.M. & Van Ness, H.C. Introduction to Chemical Engineering Thermodynamics. McGraw-Hill, 1987.

Assessment methods and criteria:

Combination of examinations and exercises
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Juha Tanskanen

Working life cooperation:

No

Other information:

-

477308S: Multicomponent Mass Transfer, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ainassaari, Kaisu Maritta, Muurinen, Esa Ilmari

Opintokohteen kielet: Finnish

Leikkaavuudet:

470302S	Multicomponent Separation	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish, can be completed in English as a book examination

Timing:

Implementation in spring semester during 4 th period. It is recommended to complete the course at the fourth (first Master's) spring semester

Learning outcomes:

Upon completing the required course work the student is able to formulate matrix equations describing mass transfer in multicomponent systems using the theory of Maxwell-Stefan and the laws of Fick for laminar and turbulent systems. He/she is also able to define bootstrap relations to bind the general equations to the physical situation of the problem, and is capable of applying the methods to estimate diffusion and mass transfer coefficients. In addition, he/she is able to describe the theories for mass transfer through phase interface, to calculate the multicomponent phase equilibrium formed by mass transfer across fluid interphase with equations of state and activity coefficient correlations, and to explain the experimental methods to measure vapour-liquid equilibrium and the methods to estimate the validity of measured values. After completing the course the student is capable of applying models of mass transfer and phase equilibrium to model and design multicomponent processes (e.g. distillation and condensation) based on diffusion.

Contents:

Maxwell-Stefan equations. Fick’s law.Estimation of diffusion coefficients.Multicomponent systems. Mass transfer coefficients. Film theory. Mass transfer models for dynamic systems. Mass transfer in turbulent flows. Simultaneous mass and heat transfer. Vapour-liquid equilibrium and experimental determination. Mass transfer models in multicomponent distillation. Condensation of vapour mixtures.

Mode of delivery:

Face-to-face teaching in Finnish (book examination in English)

Learning activities and teaching methods:

Lectures 30 h, exercises 8 h, simulation exercise 15 h and self-study 80 h. For foreign students: a written examination based on given literature and simulation exercise

Target group:

Master’s degree students of process and environmental engineering

Prerequisites and co-requisites:

Courses 477303A Mass Transfer or 477312A Heat and Mass Transfer, 477304A Separation Processes and 031019P Matrix Algebra are recommended beforehand

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Taylor, R. & Krishna, R.: Multicomponent Mass Transfer, John Wiley & Sons, 1993, 579 p.; Henley, E.J. &Seader, J.D.: Equilibrium-stage Separation Operations in Chemical Engineering, John Wiley & Sons, 1982, 742 p.
Additional literature: Walas, S.M.: Phase Equilibria in Chemical Engineering, Butterworth Publishers, 1985, 671 pp.

Assessment methods and criteria:

Examination or a learning diary and a simulation exercise. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Laboratory manager Dr Esa Muurinen

Working life cooperation:

No

Other information:

-

477306S: Non-ideal Reactors, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

Leikkaavuudet:

470222A	Reactor Analysis and Design II	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in the autumn semester during the 2nd period. It is recommended to complete the course at the fourth (1st Master's) autumn semester.

Learning outcomes:

After completing the course the student can analyse the effect of non-ideal mixing conditions on the behaviour of a reactor. He/she is capable of explaining the mechanisms of heterogeneous reactions, especially with methods that are used to analyse the effect of mass and heat transfer on the observed kinetics of heterogeneous reactions. The student has rudimentary skills to conduct demanding reactor analysis and to design heterogeneous reactors.

Contents:

Mixing models of a flowing material. Residence time distribution theory. Heterogeneous catalysis and biochemical reactions: mechanisms, mass and heat transfer, and reactor design. Gas-liquid reactions: mechanisms, mass transfer, and reactor design. Design heuristics. Microreactors.

Mode of delivery:

Lectures including exercises, face-toface teaching.

Learning activities and teaching methods:

Lectures 35 h, exercises 12 h, homework 12 h, self-study 74 h.

Target group:

Master's degree students of Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

Courses 477201A Energy and Material Balances and 477202A Reactor Analysis are recommended beforehand.

Recommended optional programme components:

-

Recommended or required reading:

Nauman, E.B.: Chemical Reactor Design. New York, John Wiley & Sons.1987; Winterbottom, J.M. & King, M.B. (Editors) Reactor Design for Chemical Engineers. Padstow 1999, T.J. International Ltd. 442 s.
Additional literature: Gianetto, A. &Silveston, P.L.: Multiphase Chemical Reactors: Theory, Design, Scale-up. Hemisphere, Washington, D. 1986; Froment, G. & Bischoff, K.B.: Chemical Reactor

Analysis and Design. New York, John Wiley & Sons. 1990; Hessel, V., Hardt, S. &Löwe, H.: Chemical Micro Process Engineering. Weinheim 2004, Wiley-VHC Verlag GmbH & Co. 674 p, Salmi, T., Mikkola, J.-P.&Wärnå, J. Chemical reaction engineering and reactor technology. Boca Raton 2011, CRC Press, 615 p.

Assessment methods and criteria:

Examination. Homework assignments affect the course grade. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Riitta Keiski

Working life cooperation:

No

Other information:

By means of the residence time distribution theory, students adopt a way of thinking in modeling which is based on the concept of probability.

477224S: Biorefineries, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Period 2 (autumn term)

Learning outcomes:

By completing the course the student understands the state-of-the-art technology level of the processing of biofuels, biochemicals and energy from lignocellulosic biomass. She/he can conclude technological and economical challenges facing the development work of biorefineries. She/he is able to apply performance criteria considering sustainable development.

Contents:

Historical background. Fossil and biomass raw material resources for energy production. Production of transportation fuels. Technology generations. Biorefineries and their categorisation. Lignocellulosic biorefineries. Production of biochemicals. Development phase of biorefineries: technical, economical and environmental considerations. Commercialisation state of nonwood biorefineries.

Mode of delivery:

Lectures and small group exercises. Occurring every two years.

Learning activities and teaching methods:

Lectures 30 h and self-study 100 h

Target group:

Master's students in the study options chemical engineering and bioprocess engineering

Prerequisites and co-requisites:

To understand the phenomena and operations present in processes, 488052A Introduction to Bioproduct and Bioprocess Engineering.

Recommended optional programme components:

-

Recommended or required reading:

Lecture handouts

Assessment methods and criteria:

Examination and other evaluation methods

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Juha Tanskanen

Working life cooperation:

No

Other information:

-

477223S: Advanced Process Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477206S	Advanced Process Design	6.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring, period 4

Learning outcomes:

The student is able to produce a preliminary chemical process concept. She/he can apply systematic process synthesis tools, chemical process simulation tools and whole process performance criteria in the conceptual process design phase. Furthermore, the student is able to produce process design documents. The student will acquire skills how to work as a member in an industrial chemical process design project. She/he will experience by team work the hierarchical character of the conceptual process design, the benefits of the systematic working methods and the need to understand the whole process performance when optimal design is sought. The student understands the importance of innovation and creative work.

Contents:

Conceptual process design and hierarchical decision making. Heuristics of process design. Design methodology: synthesis, analysis and evaluation. Design cycle. Performance evaluation of the chemical processes. Team work and meetings.

Mode of delivery:

Design projects in small groups

Learning activities and teaching methods:

Project meetings 10h and project group work 120h

Target group:

Master's students of process and environmental engineering

Prerequisites and co-requisites:

Learning outcomes of 477203A Process Design or similar knowledge

Recommended optional programme components:

Part of Process Design Module

Recommended or required reading:

Seider, W.D., Seider, J.D. and Lewin, D.R. Product and process design principles: Synthesis, analysis and evaluation. John Wiley & Sons, 2004. (Parts) ISBN 0-471-21663-1

Assessment methods and criteria:

Project work with oral and written reporting. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

No

Other information:

-

A431232: Module of The Option/Chemical Engineering, 58 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

477306S: Non-ideal Reactors, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

Leikkaavuudet:

470222A	Reactor Analysis and Design II	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in the autumn semester during the 2nd period. It is recommended to complete the course at the fourth (1st Master's) autumn semester.

Learning outcomes:

After completing the course the student can analyse the effect of non-ideal mixing conditions on the behaviour of a reactor. He/she is capable of explaining the mechanisms of heterogeneous reactions, especially with methods that are used to analyse the effect of mass and heat transfer on the observed kinetics of heterogeneous reactions. The student has rudimentary skills to conduct demanding reactor analysis and to design heterogeneous reactors.

Contents:

Mixing models of a flowing material. Residence time distribution theory. Heterogeneous catalysis and biochemical reactions: mechanisms, mass and heat transfer, and reactor design. Gas-liquid reactions: mechanisms, mass transfer, and reactor design. Design heuristics. Microreactors.

Mode of delivery:

Lectures including exercises, face-toface teaching.

Learning activities and teaching methods:

Lectures 35 h, exercises 12 h, homework 12 h, self-study 74 h.

Target group:

Master's degree students of Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

Courses 477201A Energy and Material Balances and 477202A Reactor Analysis are recommended beforehand.

Recommended optional programme components:

-

Recommended or required reading:

Nauman, E.B.: Chemical Reactor Design. New York, John Wiley & Sons.1987; Winterbottom, J.M. & King, M.B. (Editors) Reactor Design for Chemical Engineers. Padstow 1999, T.J. International Ltd. 442 s. *Additional literature:* Gianetto, A. &Silveston, P.L.: Multiphase Chemical Reactors: Theory, Design, Scale-up. Hemisphere, Washington, D. 1986; Froment, G. & Bischoff, K.B.: Chemical Reactor Analysis and Design. New York, John Wiley & Sons. 1990; Hessel, V., Hardt, S. &Löwe, H.: Chemical Micro Process Engineering. Weinheim 2004, Wiley-VHC Verlag GmbH & Co. 674 p, Salmi, T., Mikkola, J.-P.&Wärnå, J. Chemical reaction engineering and reactor technology. Boca Raton 2011, CRC Press, 615 p.

Assessment methods and criteria:

Examination. Homework assignments affect the course grade. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Riitta Keiski

Working life cooperation:

No

Other information:

By means of the residence time distribution theory, students adopt a way of thinking in modeling which is based on the concept of probability.

477309S: Process and Environmental Catalysis, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

470226S	Catalytic Processes	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester, during 1 st period. It is recommended to complete the course at the fourth (1 st Master's) autumn semester.

Learning outcomes:

After the course the student is able to define the fundamentals and history of catalysis and he/she can explain the economical and environmental meaning of catalysis. The student is capable of specifying the design, selection and testing of catalysts and catalytic reactors and processes.
He/she is able to explain the most important industrial catalytic processes, the use of catalysts in environmental technology, catalyst research and the significance of an interdisciplinary approach in the preparation, development and use of catalysts. He/she recognizes the connection between catalysis and green chemistry and the role of catalysis in sustainable processes and energy production.

Contents:

Definition of catalysis and a catalyst, history of catalysis, economical, social and environmental meaning. Preparation of catalysts, principles, selection, design and testing of catalysts and catalytic reactors. Kinetics and mechanisms of catalytic reactions, catalyst deactivation. Industrially important catalysts, catalytic reactors and catalytic processes. Environmental catalysis. Catalysts in air pollution control and purification of waters. Catalysis and green chemistry. Catalysis for sustainability. Principles in the design of catalytic processes.

Mode of delivery:

Lectures including design exercises, face-to-face teaching.

Learning activities and teaching methods:

Lectures 40 h, exercises 10 h, homework 30 h, self-study 53 h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I, 488010P Introduction to Process and Environmental Engineering II, and 780109P Basic Principles in Chemistry are recommended beforehand.

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout; Richardson, J.T.: Principles of Catalyst Development. New York. 1989, 288 pp.; Janssen, F.J.J.G. & van Santen, R.A.: Environmental Catalysis. NIOK, Catalytic Science Series, Vol. 1. 1999. 369 pp. *Additional literature:* Ertl, G., Knözinger, J. & Weitkamp, J.: Handbook of Heterogeneous Catalysis. Vol. 1-5. Weinheim. 1997, 657 p.; Thomas, J.M. & Thomas, W.J.: Principles and Practice of Heterogenous Catalysis. Weinheim 1997. 657 pp.; Somorjai, G.A.: Surface Chemistry and Catalysis. New York 1994, 667 pp.; van Santen, R.A., van Leuwen, P.W.N.M., Mouljin, J.A. & Averill, B.A.: Catalysis: An Integrated Approach, 2nd ed. Studies in Surface Science and Catalysis 123. Amsterdam 1999, Elsevier Sci. B.V. 582 pp.

Assessment methods and criteria:

Written examination and homework.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Post-doctoral research fellow Tanja Kolli

Working life cooperation:

No

Other information:

-

477310S: Advanced Catalytic Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

Leikkaavuudet:

480360S	Catalysts in Environmental Technology	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 nd period every even year.

Learning outcomes:

After completing the course the student can explain the interdisciplinary connection of catalysis with material and surface science, define new catalyst preparation methods and application areas, catalytic reaction and process engineering, and methods in catalyst research (experimental and computational methods). He/she is also able to design and do research work by emphasising research methods and innovations in catalysis. He/she is able to explain the latest knowledge connected to catalyst research and applications. He/she is also capable of explaining the relation and differences between heterogeneous, homogeneous and biocatalysis.

Contents:

The course contents are divided into the following themes 1) surface chemistry and catalysis, 2) new catalyst preparation methods, 3) catalysis for a sustainable production and energy, and green chemistry and engineering and catalysis, 4) design of catalysts and catalytic processes (reactor and process intensification, process improvements, new catalysts and catalytic processes, new opportunities by catalysis), 5) phenomena integration and catalysis and 6) new innovations in catalyst research.

Mode of delivery:

Lectures and a seminar work, face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h, seminar work 25 h, self-study 78 h.

Target group:

Master’s degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477309S Process and Environmental Catalysis and 488204A Air Pollution Control Engineering.

Recommended optional programme components:

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Recommended or required reading:

Thomas, J.M. & Thomas, W.J.: Principles and Practice of Heterogeneous Catalysis. Weinheim 1997. 657 p.; Somorjai, G.A.: Surface Chemistry and Catalysis. New York 1994. 667 p.; Van Santen, R.A., van Leuwen, P.W.N.M., Moulijn, J.A. & Averill, B.A.: Catalysis: An Integrated Approach, 2nd. edition. Research Articles.
Further literature: Ertl, G., Knözinger, H. &Weitkamp, J.: Handbook of Heterogeneous Catalysis. Vol. 1-5. Weinheim 1997; Morbidelli, M., Gavriilidis, A. &Varma, A.: Catalyst Design, Optimal Distribution of Catalyst in Pellets, Reactors, and membranes. New York 2001, Cambridge University Press. 227 p.; Anastas, P.T. & Crabtree, R.H. (eds.): Green catalysis, volume 2: Heterogeneous Catalysis. Weinheim 2009, 338 p.

Assessment methods and criteria:

Written examination and a seminar work including reporting and presentation. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University researcher Satu Ojala

Working life cooperation:

No

Other information:

-

477311S: Advanced Separation Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 nd period every odd year

Learning outcomes:

After completing the course the student is able to review the most recent methods and techniques for separation and purification of components and products, e.g. in the chemical, food, and biotechnology industries. He/she is able to define the principles of green separation processes and their research status and potentiality in industrial applications.

Contents:

The course is divided into lectures given by visiting experts from different fields (industry, research institutes and universities) and seminars given by students and senior researchers. The lectures open up the newest innovations in separation and purification technologies. The lectures can include for example the following themes: Phenomena in Supercritical fluid extraction, Pressure-activated membrane processes, Reverse osmosis, Nanofiltration, Ultrafiltration, Microfiltration, Pervaporation, Polymer membranes, Dialysis, Electrolysis and Ion-exchange, Forces for adsorption and Equilibrium adsorption isotherms, Sorbent materials and heterogeneity of surfaces, Predicting mixture adsorption, Rate processes in adsorption/adsorbers and adsorber dynamics, Cyclic adsorption processes, Temperature and pressure swing adsorption. Innovative separation methods, Phenomena integration, New hybrid materials as separation agents. Fluids and their application in gas extraction processes, Solubility of compounds in supercritical fluids and phase equilibrium.Extraction from solid substrates: Fundamentals, hydrodynamics and mass transfer, applications and processes (including supercritical water and carbon dioxide). Counter-current multistage extraction: Fundamentals and methods, hydrodynamics and mass transfer, applications and processes. Solvent cycles, heat and mass transfer, methods for precipitation.Supercritical fluid chromatography.Membrane separation of gases at high pressures.The topics of the course seminars will change annually depending on the research relevance.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h, seminar work 25 h, 78 h

Target group:

Master's degree students of the Process and Environmental Engineering study programmes

Prerequisites and co-requisites:

The courses 477304A Separation Processes and 477308S Multicomponent Mass Transfer are recommended beforehand

Recommended optional programme components:

-

Recommended or required reading:

The course literature will be chosen when the course is planned. Latest scientific research articles. Further literature: Green Separation Processes, Edited by: Afonso, A.M. & Crespo, J.G. 2005 Wiley-VCH, Separation Processes in the Food and Biotechnology Industries, Edited by: Grandison, A.S. & Lewis, M.J. 1996 Woodhead Publishing.

Assessment methods and criteria:

Portfolio or written examination and a seminar work including reporting and presentation.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Riitta Keiski

Working life cooperation:

No

Other information:

-

477308S: Multicomponent Mass Transfer, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ainassaari, Kaisu Maritta, Muurinen, Esa Ilmari

Opintokohteen kielet: Finnish

Leikkaavuudet:

470302S	Multicomponent Separation	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish, can be completed in English as a book examination

Timing:

Implementation in spring semester during 4 th period. It is recommended to complete the course at the fourth (first Master's) spring semester

Learning outcomes:

Upon completing the required course work the student is able to formulate matrix equations describing mass transfer in multicomponent systems using the theory of Maxwell-Stefan and the laws of Fick for laminar and turbulent systems. He/she is also able to define bootstrap relations to bind the general equations to the physical situation of the problem, and is capable of applying the methods to estimate diffusion and mass transfer coefficients. In addition, he/she is able to describe the theories for mass transfer through phase interface, to calculate the multicomponent phase equilibrium formed by mass transfer across fluid interphase with equations of state and activity coefficient correlations, and to explain the experimental methods to measure vapour-liquid equilibrium and the methods to estimate the validity of measured values. After completing the course the student is capable of applying models of mass transfer and phase equilibrium to model and design multicomponent processes (e.g. distillation and condensation) based on diffusion.

Contents:

Maxwell-Stefan equations. Fick's law.Estimation of diffusion coefficients.Multicomponent systems. Mass transfer coefficients. Film theory. Mass transfer models for dynamic systems. Mass transfer in turbulent flows. Simultaneous mass and heat transfer. Vapour-liquid equilibrium and experimental determination. Mass transfer models in multicomponent distillation. Condensation of vapour mixtures.

Mode of delivery:

Face-to-face teaching in Finnish (book examination in English)

Learning activities and teaching methods:

Lectures 30 h, exercises 8 h, simulation exercise 15 h and self-study 80 h. For foreign students: a written examination based on given literature and simulation exercise

Target group:

Master's degree students of process and environmental engineering

Prerequisites and co-requisites:

Courses 477303A Mass Transfer or 477312A Heat and Mass Transfer, 477304A Separation Processes and 031019P Matrix Algebra are recommended beforehand

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Taylor, R. & Krishna, R.: Multicomponent Mass Transfer, John Wiley & Sons, 1993, 579 p.; Henley, E.J. &Seader, J.D.: Equilibrium-stage Separation Operations in Chemical Engineering, John Wiley & Sons, 1982, 742 p.
Additional literature: Walas, S.M.: Phase Equilibria in Chemical Engineering, Butterworth Publishers, 1985, 671 pp.

Assessment methods and criteria:

Examination or a learning diary and a simulation exercise. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Laboratory manager Dr Esa Muurinen

Working life cooperation:

No

Other information:

-

477305S: Flow Dynamics, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Muurinen, Esa Ilmari

Opintokohteen kielet: Finnish

Leikkaavuudet:

470303S Flow Dynamics 3.5 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish, can be completed in English as a book examination (see Mode of Delivery)

Timing:

Implementation in autumn semester during 1st period. It is recommended to complete the course at the fourth (1st Master's) autumn semester.

Learning outcomes:

After completing the course the student is able to formulate the partial differential equations describing flow of fluids and to solve these equations in systems with simple geometry using difference, finite element and finite volume methods. The student is also able to formulate and solve the equations describing flow of granular material based on molecular dynamics. He/she is able to choose the experimental methods for validation of the calculated results and the methods to measure the most common properties describing fluid flow. After the course the student is able to model simple flow configurations using CFD and to design experimental systems and measurements for verifying computational results.

Contents:

Equations in fluid dynamics. Partial differential equations. Difference method. Graphical representation. Modelling the turbulence. Finite element method. Finite volume method. Molecular dynamics. Experimental fluid dynamics.

Mode of delivery:

Lectures and compulsory exercise done in small groups (in the English version, compulsory simulation exercise in small groups and a book exam, which replaces the lectures given in English)

Learning activities and teaching methods:

Lectures 25 h, and exercise 15 h, self-study 93 h. For foreign students written examination based on given literature and a simulation exercise.

Target group:

Master’s degree students of process and environmental engineering.

Prerequisites and co-requisites:

Courses 477301A Momentum Transfer or 477052A Fluid Mechanics, 031019P Matrix Algebra and 031022P Numerical Methods are recommended beforehand.

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Anderson J.D.: Computational Fluid Dynamics, McGraw-Hill, 1995, 608 p. Hämäläinen J. & Järvinen J.: Elementtimenetelmävirtauslaskennassa, CSC – Tieteellinenlaskenta Oy, 1994, 212 p. Versteeg, H.K. &Malalasekera, W.: An Introduction to Computational Fluid Dynamics, Longman Scientific and Technical, 1995, 257 p. Pöschel, T. & Schwager, T.: Computational Granular Dynamics, 2005, 322 p. Tavoularis, S.: Measurements in Fluid Mechanics, 2005, 354 p.
Additional literature: Shaw, C.T.: Using Computational Fluid Dynamics, Prentice Hall, 1992, 251 p.; Nakayama, Y. & Boucher, R.F.: Introduction to Fluid Mechanics, Arnold, 1999, 308 p.: Haataja J., Käpyaho, J. &Rahola, J.: Numeerisetmenetelmät. CSC – Tieteellinenlaskenta Oy, 1993, 236 p; Rathakrishnan, E.: Instrumentation, Measurements, and Experiments in Fluids, 2007, 492 p.

Assessment methods and criteria:

Examination or a learning diary and exercise.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Person responsible:

Laboratory manager Dr Esa Muurinen

Working life cooperation:

No

Other information:

-

477204S: Chemical Engineering Thermodynamics, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Period 1 (autumn term)

Learning outcomes:

By completing the course the student understands classical thermodynamics from a chemical engineering viewpoint. Especially she/he can explain the pVT behaviour of pure substances and understands the thermodynamic properties of mixtures. The student can classify the thermodynamic models describing, for example, liquid mixtures or electrolytes. The student can select appropriate models for gas, vapour and liquid phases. In addition, the student can solve process models, phase equilibrium and chemical reaction equilibrium problems, and more generally, is able to evaluate chemical processes using thermodynamic analysis tools.

Contents:

Mass and energy balances, pVT behaviour of pure substances, thermodynamic properties of fluids, thermodynamics of electrolytes, chemical reaction equilibrium, vapour/liquid equilibrium, calculation of thermodynamical state functions, thermodynamic analysis of processes.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 34h and self-study 99h

Target group:

Students in the study options Process Design and Chemical Engineering

Prerequisites and co-requisites:

Thermodynamic equilibria

Recommended optional programme components:

Part of the Process Design Module

Recommended or required reading:

Lecture handout. Material given during the lectures. Additional literature, Smith, J.M. & Van Ness, H.C. Introduction to Chemical Engineering Thermodynamics. McGraw-Hill, 1987.

Assessment methods and criteria:

Combination of examinations and exercises
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Juha Tanskanen

Working life cooperation:

No

Other information:

-

477209S: Chemical Process Simulation, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jani Kangas

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Autumn, periods 1-2

Learning outcomes:

The student has the ability to convert a process flow diagram into a form compatible with process simulation software. She/he has skills to evaluate realistic process conditions in a typical chemical process. The student can apply proper thermodynamic property models for simulation purposes. She/he can name the advantages and disadvantages of using the sequential modular solving approach in chemical process modelling and simulation. She/he is capable of solving a computer simulation case for a typical chemical process. The student is able to analyze the simulation results with respect to realistic values.

Contents:

The structure of a process simulator. Thermodynamic property models and databanks. Degrees of freedom analysis. Steady-state simulation. Sequential modular, and equation-oriented approaches in simulation. Numerical solving methods. Heuristics for chemical process simulation.

Mode of delivery:

Face-to-face teaching, introductory examples and group exercises with process simulation software.

Learning activities and teaching methods:

Guided exercises 32h and group work 98h

Target group:

Master's students in Chemical Engineering study option

Prerequisites and co-requisites:

477204S Chemical Engineering Thermodynamics or equivalent knowledge

Recommended optional programme components:

-

Recommended or required reading:

Material distributed on lectures. Additional literature, Turton, R., Bailie, R.C., Whiting, W.B. & Shaeiwitz, J. A.: Analysis, synthesis, and design of chemical processes. 3 rd Ed. Prentice Hall. (Parts) ISBN 0-13-512966-4.

Assessment methods and criteria:

Group exercise reports and a simulation study exam performed individually.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr Jani Kangas

Working life cooperation:

No

Other information:

-

477524S: Process Optimization, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay477524S	Process Optimization (OPEN UNI)	5.0 op
477504S	Process Optimization	4.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring semester, the 3th period. Recommended for 1st year M.Sc. students.

Learning outcomes:

Student can use and apply standard unconstrained and constrained optimization methods. Student can define and identify optimization problems. Student is able to summarize the role of optimization in process engineering.

Contents:

Basic concepts of optimization. Optimization of unconstrained and constrained functions. Linear programming. Trajectory optimization. Hierarchical optimization. Intelligent methods in optimization. Applications in process engineering.

Mode of delivery:

Face-to-face teaching and exercises as group work

Learning activities and teaching methods:

The amount of guided teaching is 40 hrs. Contact teaching includes, depending on situation, lectures, group work and tutored group work. During self-study time student does independent or group work.

Target group:

M.Sc. students of process and environmental engineering and M.Sc. students interested in process optimization. Exchange and other international students.

Prerequisites and co-requisites:

No prerequisites but basic understanding on numerical methods and process modelling are useful.

Recommended optional programme components:

See prerequisites

Recommended or required reading:

Reading materials. Ray, W.H. & Szekely, J. (1973) Process Optimization with Applications in Metallurgy and Chemical Engineering. John Wiley & Sons.

Assessment methods and criteria:

This course uses continuous assessment that includes solved exercises and lecture exams. Final exam is also possible.

Grading:

The course unit uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

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477223S: Advanced Process Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477206S	Advanced Process Design	6.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring, period 4

Learning outcomes:

The student is able to produce a preliminary chemical process concept. She/he can apply systematic process synthesis tools, chemical process simulation tools and whole process performance criteria in the conceptual process design phase. Furthermore, the student is able to produce process design documents. The student will acquire skills how to work as a member in an industrial chemical process design project. She/he will experience by team work the hierarchical character of the conceptual process design, the benefits of the systematic working methods and the need to understand the whole process performance when optimal design is sought. The student understands the importance of innovation and creative work.

Contents:

Conceptual process design and hierarchical decision making. Heuristics of process design. Design methodology: synthesis, analysis and evaluation. Design cycle. Performance evaluation of the chemical processes. Team work and meetings.

Mode of delivery:

Design projects in small groups

Learning activities and teaching methods:

Project meetings 10h and project group work 120h

Target group:

Master's students of process and environmental engineering

Prerequisites and co-requisites:

Learning outcomes of 477203A Process Design or similar knowledge

Recommended optional programme components:

Part of Process Design Module

Recommended or required reading:

Seider, W.D., Seider, J.D. and Lewin, D.R. Product and process design principles: Synthesis, analysis and evaluation. John Wiley & Sons, 2004. (Parts) ISBN 0-471-21663-1

Assessment methods and criteria:

Project work with oral and written reporting. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

No

Other information:

-

477224S: Biorefineries, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Period 2 (autumn term)

Learning outcomes:

By completing the course the student understands the state-of-the-art technology level of the processing of biofuels, biochemicals and energy from lignocellulosic biomass. She/he can conclude technological and economical challenges facing the development work of biorefineries. She/he is able to apply performance criteria considering sustainable development.

Contents:

Historical background. Fossil and biomass raw material resources for energy production. Production of transportation fuels. Technology generations. Biorefineries and their categorisation. Lignocellulosic biorefineries. Production of biochemicals. Development phase of biorefineries: technical, economical and environmental considerations. Commercialisation state of nonwood biorefineries.

Mode of delivery:

Lectures and small group exercises. Occurring every two years.

Learning activities and teaching methods:

Lectures 30 h and self-study 100 h

Target group:

Master’s students in the study options chemical engineering and bioprocess engineering

Prerequisites and co-requisites:

To understand the phenomena and operations present in processes, 488052A Introduction to Bioproduct and Bioprocess Engineering.

Recommended optional programme components:

-

Recommended or required reading:

Lecture handouts

Assessment methods and criteria:

Examination and other evaluation methods

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Juha Tanskanen

Working life cooperation:

No

Other information:

-

477207S: Industrial Water and Wastewater Technologies, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tiina Leiviskä

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish. The course can be completed in English as a book examination.

Timing:

Spring period 3

Learning outcomes:

After completing the course student knows water use and management of water-intensive industrial sectors. He/she knows industrial raw water, process water and waste water treatment technologies and can evaluate optimal usage of water by considering external requirements as well as technical and economical factors. He/she can select water treatment operations on the basis of case-specific needs.

Contents:

Industrial water management. Physical, chemical and biological water treatment operations used by process industry. Detailed description of chemical water treatment processes. Pre-treatment of raw water, treatment of process water and water reuse, waste water treatment, disinfection.

Mode of delivery:

Lectures, group work and self-study

Learning activities and teaching methods:

Lectures 30h, group work 10h and self-study 90h

Target group:

Master’s students e.g. in the Process Design study option

Prerequisites and co-requisites:

-

Recommended optional programme components:

Part of Process Design Module

Recommended or required reading:

Material distributed in lectures. Additional literature, McCabe, W., Smith, J., Harriot, P.: Unit Operations of Chemical Engineering; Sincero, A., Sincero, A.: Physical-Chemical Treatment of Water and Wastewater, IWA Publishing, CRC Press

Assessment methods and criteria:

The students will be making an essay and a group exercise, which both will be evaluated. Student will participate in final exam after the course.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr Tiina Leiviskä

Working life cooperation:

No

Other information:

-

H431231: Module of the Option/Extractive Metallurgy, 60 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

A431233: Module of the Option/Extractive Metallurgy, 30 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

477412S: Phenomena-based modelling in extractive metallurgy, 10 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

Leikkaavuudet:

477421S	Thermodynamics in Metallurgy	6.0 op

ECTS Credits:

10 cr / 270 hours of work

Language of instruction:

Finnish

Timing:

The course is given in the autumn semester, during periods I and II. It is recommended to complete the course at the 4th autumn semester.

Learning outcomes:

Students passing the course are familiar with the most important computational methods used to investigate the most essential phenomena in the research and development of metallurgical processes. Students can e.g. calculate thermodynamic equilibria, read and construct phase stability diagrams as well as other diagrams used in the investigation of pyrometallurgical and electrochemical reactions, describe the role of inclusions in metal production, describe the structure of metallurgical slags, etc. It should however be noted that these are only examples since the contents of the course are under continuous development and therefore more detailed learning outcomes are given each year at the beginning of each course.

Contents:

Models and methods that are used to investigate the most essential chemical and physical phenomena in the research and development of metallurgical processes

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Individual and group exercises as well as contact-education (90 hours) that supports these exercises

Target group:

Students of process metallurgy

Prerequisites and co-requisites:

Knowledge and skills corresponding with the knowledge and skills that are obtained from the Bachelor-level-studies in the programme of process or environmental engineering are required as prerequisities. In order to get credits from this course, bachelor thesis must be completed.

Recommended optional programme components:

The module of process metallurgy consists of courses 477412S, 477413S and 477414S.

Recommended or required reading:

Material will be distributed during lectures and exercises. It is also available via courses www-site.

Assessment methods and criteria:

Individual and group-exercises
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Eetu-Pekka Heikkinen

Working life cooperation:

No

Other information:

It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun.

477413S: Experimental Research in Extractive Metallurgy, 10 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Tanskanen

Opintokohteen kielet: Finnish

ECTS Credits:

10 cr / 270 hours of work

Language of instruction:

Finnish

Timing:

The course is given in the spring semester, during periods III and IV. It is recommended to complete the course at the 4th spring semester.

Learning outcomes:

Students passing the course are familiar with the most important experimental and analytical methods used in the laboratory scale research of materials and metallurgical processes. Students can determine and separate research problems to reasonable pieces, collect the background information, select the reasonable methods and make the research and reporting on planned schedule. Additionally, students can observe the metallurgical phenomena and their interconnections and consequences. It should also be noted that the contents of the course are under continuous development and therefore more detailed learning outcomes are given each year at the beginning of each course.

Contents:

Typical experimental and analytical methods used to research the high temperature modification and behaviour (oxidation, reduction, melting, surface phenomena, kinetics) of materials. Determining and separating research problems to reasonable pieces, making the background research, selecting suitable methods, reporting and presenting the results.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Group exercises and contact-education (90 hours) that supports these exercises

Target group:

Students of process metallurgy

Prerequisites and co-requisites:

Knowledge and skills corresponding with the knowledge and skills that are obtained from the Bachelor-level-studies in the programme of process or environmental engineering are required as prerequisities.In order to get credits from this course, bachelor thesis must be completed.

Recommended optional programme components:

The module of process metallurgy consists of courses 477412S, 477413S and 477414S

Recommended or required reading:

Material will be distributed during lectures and exercises. It is also available via courses www-site.

Assessment methods and criteria:

Group-exercises and reports
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Pekka Tanskanen

Working life cooperation:

No

Other information:

It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun. The number of students participating in this course may be limited.

477414S: Process Simulation in Extractive Metallurgy, 10 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Fabritius, Timo Matti Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

477422A	Metallurgical Processes	6.0 op

ECTS Credits:

10 cr / 270 hours of work

Language of instruction:

Finnish

Timing:

The course is held in the autumn semester, during periods I and II. It is recommended to complete the course at the 5th autumn semester.

Learning outcomes:

Students passing the course are familiar with the metal production processes and metallurgical unit operations used in Finland and they can create process simulations describing these processes. Additionally, students can identify the boundary conditions of the process simulations created by e.g. availability of the data and possibilities to model the phenomena involved in these processes. It should also be noted that the contents of the course are under continuous development and therefore more detailed learning outcomes are given each year at the beginning of each course.

Contents:

The most important metal production processes and metallurgical unit operations used in Finland as well as modelling and simulation of these processes.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Group exercises and contact-education (90 hours) that supports these exercises

Target group:

Students of process metallurgy

Prerequisites and co-requisites:

Knowledge and skills corresponding with the knowledge and skills that are obtained from the Bachelor-level-studies in the programme of process or environmental engineering are required as prerequisities. In order to get credits from this course, bachelor thesis must be completed.

Recommended optional programme components:

The module of process metallurgy consists of courses 477412S, 477413S and 477414S

Recommended or required reading:

Material will be distributed during lectures and exercises. It is also available via courses www-site.

Assessment methods and criteria:

Group exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Timo Fabritius

Working life cooperation:

No

Other information:

It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun

A431234: Module of the Option/Mineral Processing, 60 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

477710A: Basic Course in Geology, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Heli Rautjärvi, Seppo Gehör
Opintokohteen kielet: Finnish
Leikkaavuudet:

477701A	Basic Course in Geology	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish

Timing:

In period 1 (autumn term)

Learning outcomes:

-

Contents:

-

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures, practicals, mine visit (only if resources are allowing), final exams for the lectures and practicals separately

Target group:

Master's students in the study option Mineral Processing of the study programmes Process Engineering and Environmental Engineering

Prerequisites and co-requisites:

The Bachelor level studies of process or environmental engineering study programmes or respective knowledge, and the preceding Master level studies or respective knowledge

Recommended optional programme components:

The other courses of the Master's phase curriculum

Recommended or required reading:

Materials delivered at the lectures, practicals and/or in the Optima

Assessment methods and criteria:

Final exams for the lectures and practicals separately

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Seppo Gehör or NN

Working life cooperation:

No

Other information:

-

477704A: Principles of Mineral Processing, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Saija Luukkanen

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

In period 2 (autumn term). It is recommedable to take this course on the 1st year of the Master's degree phase of his/her studies i.e. the fourth year of all

Learning outcomes:

After the course the student knows the principles of mineral processing and can explain the basic processes therein. Additionally the student has acquired the skill to recognize the essential equipment used in mineral processing and their operation. Further, the student can explain the basics of the economics of mineral processing

Contents:

Grinding methods, separation methods, process control; practical examples of mineral processing; unit processes related to optimal mineral processing

Mode of delivery:

Implemented as face-to-face teaching

Learning activities and teaching methods:

Lectures and practical exercises, final examination

Target group:

The students of the Mineral Processing study option in the study programmes Process Engineering or Environmental Engineering

Prerequisites and co-requisites:

The Bachelor level studies of process or environmental engineering study programmes or respective knowledge, and the preceding Master level studies or respective knowledge

Recommended optional programme components:

The other courses of the Master's phase curriculum

Recommended or required reading:

Materials delivered at the lectures, practicals and/or in Optima

Assessment methods and criteria:

Final examination.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Hannu Kuopanportti / NN

Working life cooperation:

No

Other information:

-

477716A: Surface Chemistry Principles and Applications in Mineral and Mining Technology, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477703A	Surface Chemistry Principles of Minerals	3.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish/English

Timing:

In spring period 3. It is recommedable to take this course on the 1st year of the Master's degree phase, i.e. the 4th year of all.

Learning outcomes:

After completing the course, student can describe mineral engineering processes and unit operations on the basis of physical chemistry. The course introduces students to surface phenomena of physical chemistry.

Contents:

Thermodynamic basic equations; chemical interactions, especially those of boundary surfaces; zeta potential, total surface charges; bubbles; surface reagents, etc.

Mode of delivery:

Implemented as face-to-face teaching (or by distant learning)

Learning activities and teaching methods:

Lectures, exercises

Target group:

The students of the Mineral Processing study option in the study programmes Process Engineering or Environmental Engineering

Prerequisites and co-requisites:

The Bachelor level studies of process or environmental engineering study programmes or respective knowledge, and the preceding Master level studies or respective knowledge

Recommended optional programme components:

The other courses of the Master's phase curriculum

Recommended or required reading:

Materials delivered at the lectures or electrically

Assessment methods and criteria:

Scored excercises. Final examination.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Jaakko Rämö (Thule Institute, University of Oulu)

Working life cooperation:

No

Other information:

Resources allowing, the course is given for the LTU students by an electronic connection (as distant learning)

477711S: Rock and Mining Engineering, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477702A	Rock Engineering	5.0 op
477707A	Mining Engineering	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Autumn term, period 2

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and a final examination

Target group:

Especially Master's students in the study option Mineral Processing of the study programmes Process Engineering and Environmental Engineering

Prerequisites and co-requisites:

The Bachelor level studies of process or environmental engineering study programmes or respective knowledge, and the preceding Master level studies or respective knowledge

Recommended optional programme components:

The other courses of the Master's phase curriculum

Recommended or required reading:

Materials delivered during the lectures and/or in Optima. *Additional literature*: Hakapää A. &. Lappalainen P. (eds.) 2011: Kaivos- ja louhintatekniikka. Opetushallitus, Kaivannaisteollisuusyhdistys. 388 p. ISBN 978-952-13-4615-6.

Assessment methods and criteria:

Final examination

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Professor Mikael Rinne (Aalto-university) or N.N.

Working life cooperation:

No

Other information:

-

477712S: Phenomena in Mineral Processing, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannu Kuopanportti, Harri Kosonen

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish

Timing:

In period 4 (spring). It is recommedable to take this course on the 1st year of the Master's degree phase of the studies i.e. on the fourth year of all.

Learning outcomes:

After the course the student is able to explain and understand the physical and chemical phenomena that effect on the operation of an enrichment method. By understanding the phenomena the student can explain the reasons for the process changes, and can explain how the process device works and can optimize the process conditions and the equipment parameters.

Contents:

Basic methods and equipment of crushing and grinding. Enrichment based on sorting. Grinding-conditioning of flotation, flotation concentration. Beneficiation methods and equipment based on density differences.Magnetic and electrostatic enrichment. Beneficiation methods based on leaching.

Mode of delivery:

Implemented as face-to-face teaching

Learning activities and teaching methods:

Lectures, final examination

Target group:

The students of the Mineral Processing study option in the degree programmes Process Engineering or Environmental Engineering

Prerequisites and co-requisites:

The Bachelor level studies of process or environmental engineering study programmes or respective knowledge, and the preceding Master level studies or respective knowledge

Recommended optional programme components:

The other courses of the Master's phase curriculum

Recommended or required reading:

Lecture materials delivered in the lectures and/or in Optima

Assessment methods and criteria:

Final examination for the lectures.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Prof. Hannu Kuopanportti / NN

Working life cooperation:

No

Other information:

-

477713S: Automation in Mineral Processing, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: Finnish

Leikkaavuudet:

477510S	Automation in Mineral Processing	5.0 op
477724S	Numerical Mine Modelling	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Implementation in the 4th period (spring term)

Learning outcomes:

The target is to give the students the skills to understand and develop models for minerals processing and apply these models in process monitoring and control.

Contents:

Models for processes like crushing, grinding, flotation, leaching, separation etc. Examples how to use these models in process control and what kind of benefits can be drawn from their use.

Mode of delivery:

Lectures and demonstrations

Learning activities and teaching methods:

Lectures during one period

Target group:

Master's students in process and environmental engineering. Exchange students.

Prerequisites and co-requisites:

Basic knowledge in minerals processing and control engineering

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes in English

Assessment methods and criteria:

Continuous evaluation: lectures and test

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

-

488115A: Geomechanics, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kauko Kujala

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course unit is given in the spring semester, during period 3

Learning outcomes:

Have a clear understanding of mechanical behaviour of soil structures in loading and environmental conditions. Understand design and dimensioning principles and can explain environmental aspects of soil behaviour.

Contents:

Origins and composition of soils, classification of soils, stress and strains in soils, mechanical properties of soils, stability of slopes, bearing capacity of foundation, seepage analyses, freezing and thawing of soils, site investigations and in situ testing.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (40 h) and calculation exercises (20 h) also independent work (75 h)

Target group:

Students in Bachelor program of Environmental Engineering

Prerequisites and co-requisites:

No

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout and other materials delivered in lectures

Assessment methods and criteria:

Examination
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Kujala

Working life cooperation:

No

Other information:

-

477207S: Industrial Water and Wastewater Technologies, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tiina Leiviskä

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish. The course can be completed in English as a book examination.

Timing:

Spring period 3

Learning outcomes:

After completing the course student knows water use and management of water-intensive industrial sectors. He/she knows industrial raw water, process water and waste water treatment technologies and can evaluate optimal usage of water by considering external requirements as well as technical and economical factors. He/she can select water treatment operations on the basis of case-specific needs.

Contents:

Industrial water management. Physical, chemical and biological water treatment operations used by process industry. Detailed description of chemical water treatment processes. Pre-treatment of raw water, treatment of process water and water reuse, waste water treatment, disinfection.

Mode of delivery:

Lectures, group work and self-study

Learning activities and teaching methods:

Lectures 30h, group work 10h and self-study 90h

Target group:

Master’s students e.g. in the Process Design study option

Prerequisites and co-requisites:

-

Recommended optional programme components:

Part of Process Design Module

Recommended or required reading:

Material distributed in lectures. Additional literature, McCabe, W., Smith, J., Harriot, P.: Unit Operations of Chemical Engineering; Sincero, A., Sincero, A.: Physical-Chemical Treatment of Water and Wastewater, IWA Publishing, CRC Press

Assessment methods and criteria:

The students will be making an essay and a group exercise, which both will be evaluated. Student will participate in final exam after the course.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr Tiina Leiviskä

Working life cooperation:

No

Other information:

-

488221S: Environmental Load of Industry, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Niina Koivikko

Opintokohteen kielet: English

Leikkaavuudet:

488215S	Industry and Environment	5.0 op
488205S	Environmental Load of Process Industry	4.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during 3 rd period.

Learning outcomes:

The student is able to identify the essential features of the environmental load in different types of (chemical, wood, metallurgical, etc.) industry. He/she is able to explain the type, quality, quantity and sources of the emissions. The student is familiarized with the main emission control systems and techniques in different industrial sectors. He/she has the skills to apply BAT-techniques in emission control. The student can explain the environmental management system of an industrial plant and is able to apply it to an industrial plant.

Contents:

Effluents: types, quality, quantity, sources. Unit operations in managing effluents, comprehensive effluent treatment. Environmental management systems, environmental licences, environmental reporting and BAT.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 40 h, self-study 93h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I, 488011P Introduction to Process and Environmental Engineering II, 488204S Air Pollution Control Engineering and 488110S Water and Wastewater Treatment recommended before-hand.

Recommended optional programme components:

-

Recommended or required reading:

Material represented in lectures and in the Optima environment.

Assessment methods and criteria:

Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:

University researcher Satu Ojala

Working life cooperation:

No

Other information:

Expert lecturers may be invited from industry to give specific lectures related to the organization.

488203S: Industrial Ecology, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Väisänen, Virpi Maria

Opintokohteen kielet: English

Leikkaavuudet:

ay488203S	Industrial Ecology and Recycling	5.0 op
480370S	Industrial Ecology and Recycling	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 th period.

Learning outcomes:

Upon completion of the course, the student will be able to use the tools of industrial ecology and apply them to industrial activity. The student can also analyze the interaction of industrial, natural and socio-economic systems and able to judiciously suggest changes to industrial practice in order to prevent negative impacts. The student can also analyze the examples of industrial symbioses and eco-industrial parks and able to specify the criteria of success for building eco-industrial parks.

Contents:

Material and energy flows in economic systems and their environmental impacts. Physical, biological and societal framework of industrial ecology. Industrial metabolism, corporate industrial ecology, eco-efficiency, dematerialization. Tools of industrial ecology, such as life-cycle assessment, design for the environment, green chemistry and engineering. Systems-level industrial ecology, industrial symbioses, eco-industrial parks.

Mode of delivery:

Face-to-face teaching in English.

Learning activities and teaching methods:

Lectures 30 h / Group work 20 h / Self-study 83 h. The exercises are completred as group work

Target group:

Master's degree students of process and environmental engineering.

Prerequisites and co-requisites:

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Recommended optional programme components:

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Recommended or required reading:

Lecture notes; Graedel T.E & Allenby B.R.: Industrial Ecology. New Jersey: Prentice Hall, 2003.

Assessment methods and criteria:

All students complete the course in a final exam. Also the exercise will be assessed. The assessment criteria are based on the learning outcomes of the course.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Virpi Väisänen

Working life cooperation:

No

Other information:

-

488133A: Environmental Impact Assessment, 5 op

Voimassaolo: 01.08.2015 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488103A	Environmental Impact Assessment	4.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given in the autumn semester, during period 1

Learning outcomes:

The student will acquire a broad and multidisciplinary and sustainable approach to environmental impact assessment (EIA). The student will know the all steps in EIA process and the different methods used in environmental impact assessment. During the course students develop their working life skills (e.g. writing, communication and presentation skills) and the ability to review environmental problems. Thy also learn how to resolve extensive environmental projects related problems, causes and consequences.

Contents:

EIA process and legislation, environmental change, principles and assessment methods in ecology, hydrology, economics and social sciences

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

The course contains lectures (20 h), seminars (9 h) and independent works (106 h)

Target group:

Master students in the Environmental Engineering study program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering I (477011P) and II (488010P)

Recommended optional programme components:

-

Recommended or required reading:

Environmental Impact Assessment: Cutting Edge for the Twenty-First Century (Gilpin A, 1995, ISBN 0-521-42967-6). Lecture hand-outs and other materials delivered in lectures.

Assessment methods and criteria:

The assignement (60 %) and seminar (40%). More information about assessment methods of each module is given during the course.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

The course is arranged in alternate years (even autumn semesters). The course is organised in a co-operation with the Faculty of Technology and the Thule Institute.

477715S: Environmental and Social Responsibility in Mining, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jaakko Rämö

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Organized resources allowing

Learning outcomes:

After completion of this course the student is able to develop, pply and assess the targets, practices and methods of environmentally and socially responsible mining in practice

Contents:

Environmentally and socially responsible mining

Mode of delivery:

Implemented as distance learning

Learning activities and teaching methods:

Lectures and exercises by distance learning and learning diaries

Target group:

The students of the Mineral Processing study option in the study programmes Process Engineering or Environmental Engineering, etc. and the students of Luleå University of Technology (LTU) within the Nordic Mining School (NMS) agreement between LTU and the University of Oulu

Prerequisites and co-requisites:

The Bachelor level studies of the process or environmental engineering study programmes or respective knowledge, and the preceding Master level studies or respective knowledge

Recommended optional programme components:

The other courses of the Master's phase curriculum

Recommended or required reading:

Lectures and articles delivered during lectures

Assessment methods and criteria:

Active participation to the lectures and a learning diary.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Prof. Rauno Sairinen (University of Eastern Finland) or NN, Nordic Mining School Coordinator Jaakko Rämö (Thule Institute, University of Oulu)

Working life cooperation:

No

Other information:

This course is organized within the Nordic Mining School (NMS) agreement between Luleå University of Technology, Sweden and the University of Oulu

A431235: Module of the Option/Industrial Energy and Environmental Engineering, 60 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

477223S: Advanced Process Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477206S	Advanced Process Design	6.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring, period 4

Learning outcomes:

The student is able to produce a preliminary chemical process concept. She/he can apply systematic process synthesis tools, chemical process simulation tools and whole process performance criteria in the conceptual process design phase. Furthermore, the student is able to produce process design documents. The student will acquire skills how to work as a member in an industrial chemical process design project. She/he will experience by team work the hierarchical character of the conceptual process design, the benefits of the systematic working methods and the need to understand the whole process performance when optimal design is sought. The student understands the importance of innovation and creative work.

Contents:

Conceptual process design and hierarchical decision making. Heuristics of process design. Design methodology: synthesis, analysis and evaluation. Design cycle. Performance evaluation of the chemical processes. Team work and meetings.

Mode of delivery:

Design projects in small groups

Learning activities and teaching methods:

Project meetings 10h and project group work 120h

Target group:

Master's students of process and environmental engineering

Prerequisites and co-requisites:

Learning outcomes of 477203A Process Design or similar knowledge

Recommended optional programme components:

Part of Process Design Module

Recommended or required reading:

Seider, W.D., Seider, J.D. and Lewin, D.R. Product and process design principles: Synthesis, analysis and evaluation. John Wiley & Sons, 2004. (Parts) ISBN 0-471-21663-1

Assessment methods and criteria:

Project work with oral and written reporting. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

No

Other information:

-

477224S: Biorefineries, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Period 2 (autumn term)

Learning outcomes:

By completing the course the student understands the state-of-the-art technology level of the processing of biofuels, biochemicals and energy from lignocellulosic biomass. She/he can conclude technological and economical challenges facing the development work of biorefineries. She/he is able to apply performance criteria considering sustainable development.

Contents:

Historical background. Fossil and biomass raw material resources for energy production. Production of transportation fuels. Technology generations. Biorefineries and their categorisation. Lignocellulosic biorefineries. Production of biochemicals. Development phase of biorefineries: technical, economical and environmental considerations. Commercialisation state of nonwood biorefineries.

Mode of delivery:

Lectures and small group exercises. Occurring every two years.

Learning activities and teaching methods:

Lectures 30 h and self-study 100 h

Target group:

Master's students in the study options chemical engineering and bioprocess engineering

Prerequisites and co-requisites:

To understand the phenomena and operations present in processes, 488052A Introduction to Bioproduct and Bioprocess Engineering.

Recommended optional programme components:

-

Recommended or required reading:

Lecture handouts

Assessment methods and criteria:

Examination and other evaluation methods

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Juha Tanskanen

Working life cooperation:

No

Other information:

-

477309S: Process and Environmental Catalysis, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

470226S Catalytic Processes 5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester, during 1 st period. It is recommended to complete the course at the fourth (1 st Master's) autumn semester.

Learning outcomes:

After the course the student is able to define the fundamentals and history of catalysis and he/she can explain the economical and environmental meaning of catalysis. The student is capable of specifying the design, selection and testing of catalysts and catalytic reactors and processes.
He/she is able to explain the most important industrial catalytic processes, the use of catalysts in environmental technology, catalyst research and the significance of an interdisciplinary approach in the preparation, development and use of catalysts. He/she recognizes the connection between catalysis and green chemistry and the role of catalysis in sustainable processes and energy production.

Contents:

Definition of catalysis and a catalyst, history of catalysis, economical, social and environmental meaning. Preparation of catalysts, principles, selection, design and testing of catalysts and catalytic reactors. Kinetics and mechanisms of catalytic reactions, catalyst deactivation. Industrially important catalysts, catalytic reactors and catalytic processes. Environmental catalysis. Catalysts in air pollution control and purification of waters. Catalysis and green chemistry. Catalysis for sustainability. Principles in the design of catalytic processes.

Mode of delivery:

Lectures including design exercises, face-to-face teaching.

Learning activities and teaching methods:

Lectures 40 h, exercises 10 h, homework 30 h, self-study 53 h.

Target group:

Master’s degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I, 488010P Introduction to Process and Environmental Engineering II, and 780109P Basic Principles in Chemistry are recommended beforehand.

Recommended optional programme components:

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Recommended or required reading:

Lecture handout; Richardson, J.T.: Principles of Catalyst Development. New York. 1989, 288 pp.; Janssen, F.J.J.G. & van Santen, R.A.: Environmental Catalysis. NIOK, Catalytic Science Series, Vol. 1. 1999. 369 pp. *Additional literature:*Ertl, G., Knözinger, J. & Weitkamp, J.: Handbook of Heterogeneous Catalysis. Vol. 1-5. Weinheim. 1997, 657 p.; Thomas, J.M. & Thomas, W.J.: Principles and Practice of Heterogenous Catalysis. Weinheim 1997. 657 pp.; Somorjai, G.A.: Surface Chemistry and Catalysis. New York 1994, 667 pp.; van Santen, R.A., van Leuwen, P.W.N.M., Mouljin, J.A. & Averill, B.A.: Catalysis: An Integrated Approach, 2nd ed. Studies in Surface Science and Catalysis 123. Amsterdam 1999, Elsevier Sci. B.V. 582 pp.

Assessment methods and criteria:

Written examination and homework.

Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Post-doctoral research fellow Tanja Kolli

Working life cooperation:

No

Other information:

-

488133A: Environmental Impact Assessment, 5 op

Voimassaolo: 01.08.2015 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488103A	Environmental Impact Assessment	4.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given in the autumn semester, during period 1

Learning outcomes:

The student will acquire a broad and multidisciplinary and sustainable approach to environmental impact assessment (EIA). The student will know the all steps in EIA process and the different methods used in environmental impact assessment. During the course students develop their working life skills (e.g. writing, communication and presentation skills) and the ability to review environmental problems. Thy also learn how to resolve extensive environmental projects related problems, causes and consequences.

Contents:

EIA process and legislation, environmental change, principles and assessment methods in ecology, hydrology, economics and social sciences

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

The course contains lectures (20 h), seminars (9 h) and independent works (106 h)

Target group:

Master students in the Environmental Engineering study program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering I (477011P) and II (488010P)

Recommended optional programme components:

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Recommended or required reading:

Environmental Impact Assessment: Cutting Edge for the Twenty-First Century (Gilpin A, 1995, ISBN 0-521-42967-6). Lecture hand-outs and other materials delivered in lectures.

Assessment methods and criteria:

The assignement (60 %) and seminar (40%). More information about assessment methods of each module is given during the course.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

The course is arranged in alternate years (even autumn semesters). The course is organised in a co-operation with the Faculty of Technology and the Thule Institute.

488104A: Industrial and municipal waste management, 5 op

Voimassaolo: 01.08.2005 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisangela Heiderscheidt

Opintokohteen kielet: English

Leikkaavuudet:

480160S	Waste Management of Communities and Industry	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is organized in the autumn semester, during period 1

Learning outcomes:

The student will acquire a wilder view of what is waste and how it is generated and managed in communities and industries. Student will be familiar with waste management hierarchy and how waste legislation regulates waste management. She/he will get basic knowledge about waste treatment methods including their sustainability and related environmental impacts. As well as, how a series of factors influence the planning of waste management activities in industries and municipalities. The student will also be able to understand the energy and material recovery potential within the waste sector.

Contents:

Waste management hierarch, waste prevention principle, municipal waste management, waste management in industries, waste legislation, municipal and industrial waste treatment methods, international treaties related to waste management, waste to energy principle.

Mode of delivery:

Face-to-face teaching and guided assignments.

Learning activities and teaching methods:

Learning methods: A) Active learning method: Lectures (25 h), group work/ exercises (45 h), self-study for examination and completion of exercises (55 h) and field visits (8 h) or alternatively; B) BOOK examination: 100% self-study mode where the student is provided with 2-3 books as reference material and he/she attends an examination.

Target group:

Students in the Bachelor program of Environmental Engineering

Prerequisites and co-requisites:

-

Recommended optional programme components:

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Recommended or required reading:

Lecture hand-outs, notes and other materials delivered in lectures; Waste management: a reference handbook illustrated edition, 2008 (electronic book, ISBN 9781598841510); Pippo, S., 2013. Municipal solid waste management in Finland. Greensettle publications. ISBN 978-952-62-0071-2.

Assessment methods and criteria:

A) Active mode: *successful completion of course work which consists of* group exercises 1 and 2 and achieving a pass grade (1-5) in the final exam which is based on lectures material and exercises; B) Self-study mode: achieving a passing grade (1-5) in the exam which is based on provided reference material. Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Researcher Elisangela Heiderscheidt

Working life cooperation:

No

Other information:

-

488110S: Water and Wastewater Treatment, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisangela Heiderscheidt

Opintokohteen kielet: English

Leikkaavuudet:

480151S	Water and Wastewater Treatment	7.0 op
480208S	Industrial Water and Wastewater Treatment	3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, during period 1

Learning outcomes:

Upon completion of the course, the student will be able to understand the theory and practicalities of the most used processes in water and wastewater treatment. The student will also be capable to perform basic dimensioning calculations and therefore he/she will be able to dimension structures/units of water and wastewater treatment plant processes.

Contents:

Water quality characteristics of source water; basic principles of purification processes (coagulation/flocculation, sedimentation, biological treatment, filtration, disinfection, etc.); used process units in water and waste water treatment; selection of process units; dimensioning of treatment units and unit processes..

Mode of delivery:

Mix of guided self-study work and face-to-face teaching and field visits

Learning activities and teaching methods:

Lectures (20 h), field visits (5 h), exercises ( ), self-study (60 h)

Target group:

Students in the Master program of Environmental Engineering

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering I (477011P) and II (488010P)

Recommended optional programme components:

-

Recommended or required reading:

Lecture hand-outs, & “Lindquist, A., 2003. About water treatment. Helsingborg: Kemira Kemwater”. Optional: RIL 124-2, Vesihuolto II; Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse; AWWA, Water quality & treatment; AWWA, Water treatment plant design.

Assessment methods and criteria:

The course can be completed: A) Active mode: midterm exam based on reading material + completion of 2 group exercises + final exam based on lectures and exercises; B) BOOK exam: 100% self-study mode where the student is provided with 2-3 reference books and attends an exam based on the provided material.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Researcher Elisangela Heiderscheidt

Working life cooperation:

No

Other information:

-

488202S: Production and Use of Energy, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

488208A	Basics of production and use of energy	5.0 op
470057S	The Energy Economy of Industrial Establishments	3.5 op

ECTS Credits:

5 ECTS credits / 133 hours of work.

Language of instruction:

English

Timing:

Implementation in autumn semester during 1 st period. It is recommended to complete the course at fourth (1 st Master's) autumn semester.

Learning outcomes:

The student is able to define different methods and techniques to generate electricity and heat. He/she is able to explain steam power plant operating principles and is able to compare operation of different kinds of steam power plants. The student can describe the environmental impacts of energy production and is able to compare the environmental impacts of different ways of producing energy. The student is able to identify functioning of the fossil based and renewable energy production systems. He/she is able to explain how the electricity markets work. The student is also able to explain the adequacy of energy reserves.

Contents:

Structure of energy production and consumption. Systems for electric transportation, storing and distribution. Distribution and adequacy of energy resources. Effects of environment contracts on the use of energy resources. Environmental comparison of different energy production methods and fuels. Energy markets. Development views of energy technology.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40h, self-study 93 h.

Target group:

Master's degree students of Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P and 488010P Introduction to Process and Environmental Engineering I and II are recommended.

Recommended optional programme components:

-

Recommended or required reading:

Materials delivered via the Optima environment.

Assessment methods and criteria:

Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at [www.oulu.fi/english/studying/assessment.](www.oulu.fi/english/studying/assessment)

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Mika Huuhtanen

Working life cooperation:

No

Other information:

-

488203S: Industrial Ecology, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Väisänen, Virpi Maria

Opintokohteen kielet: English

Leikkaavuudet:

ay488203S	Industrial Ecology and Recycling	5.0 op
480370S	Industrial Ecology and Recycling	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 th period.

Learning outcomes:

Upon completion of the course, the student will be able to use the tools of industrial ecology and apply them to industrial activity. The student can also analyze the interaction of industrial, natural and socio-economic systems and able to judiciously suggest changes to industrial practice in order to prevent negative impacts. The student can also analyze the examples of industrial symbioses and eco-industrial parks and able to specify the criteria of success for building eco-industrial parks.

Contents:

Material and energy flows in economic systems and their environmental impacts. Physical, biological and societal framework of industrial ecology. Industrial metabolism, corporate industrial ecology, eco-efficiency, dematerialization. Tools of industrial ecology, such as life-cycle assessment, design for the environment, green chemistry and engineering. Systems-level industrial ecology, industrial symbioses, eco-industrial parks.

Mode of delivery:

Face-to-face teaching in English.

Learning activities and teaching methods:

Lectures 30 h / Group work 20 h / Self-study 83 h. The exercises are completred as group work

Target group:

Master's degree students of process and environmental engineering.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes; Graedel T.E & Allenby B.R.: Industrial Ecology. New Jersey: Prentice Hall, 2003.

Assessment methods and criteria:

All students complete the course in a final exam. Also the exercise will be assessed. The assessment criteria are based on the learning outcomes of the course.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Virpi Väisänen

Working life cooperation:

No

Other information:

-

488204S: Air Pollution Control Engineering, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Satu Pitkäaho

Opintokohteen kielet: English

Leikkaavuudet:

ay488204S	Air Pollution Control Engineering (OPEN UNI)	5.0 op
488213A	Sources and control of air pollution	5.0 op
480380S	Air Protection Techniques	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 nd period.

Learning outcomes:

The student is able to explain what kind of air emissions originate from certain industries and power plants, and can explain their environmental and health impacts. The student is able to explain the common air pollution control systems for different emissions (SO2, NOx, VOC, CO2, dust) and is able to design air pollution cleaning devices. He/she can describe how air emissions are measured. In addition, the student is able to describe the main laws related to air emission control.

Contents:

Effects of pollution on the atmosphere. Acid rain. Climate change. Ozone. Effects of pollution on health, nature and buildings. Legislation. Measurement of emissions. Emission control technologies, VOC emissions, SO_x emissions, NO_X emissions, heavy metals, POPs, HAPs, etc.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30h, exercises 10h and self-study 93 h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I, 488011P Introduction to Process and Environmental Engineering II and 780109P Basic Principles in Chemistry recommended beforehand.

Recommended optional programme components:

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Recommended or required reading:

Materials in the Optima environment. de Nevers; N.: Air Pollution Control Engineering. 2nd ed. McCraw-Hill 2000. 586 pp

Additional literature: Singh, H. B.: Composition, Chemistry, and Climate of the Atmosphere. New York 1995. 527 pp.; Bretschneider, B. & Kurfurst, J.: Air Pollution Control Technology. Elsevier, Amsterdam 1987. 296 pp.; Hester, R. E. & Harrison, R. M.: Volatile Organic Compound in the Atmosphere. Issues in Environmental Science and Technology. Vol. 4. Bath 1995; Hester, R. E. & Harrison, R. M.: Waste Incineration and the Environment. Issues in Environmental Science and Technology. Vol 4. Bath 1995.

Assessment methods and criteria:

Written final exam.

Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University researcher Satu Ojala

Working life cooperation:

No

Other information:

-

488221S: Environmental Load of Industry, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Niina Koivikko

Opintokohteen kielet: English

Leikkaavuudet:

488215S	Industry and Environment	5.0 op
488205S	Environmental Load of Process Industry	4.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during 3 rd period.

Learning outcomes:

The student is able to identify the essential features of the environmental load in different types of (chemical, wood, metallurgical, etc.) industry. He/she is able to explain the type, quality, quantity and sources of the emissions. The student is familiarized with the main emission control systems and techniques in different industrial sectors. He/she has the skills to apply BAT-techniques in emission control. The student can explain the environmental management system of an industrial plant and is able to apply it to an industrial plant.

Contents:

Effluents: types, quality, quantity, sources. Unit operations in managing effluents, comprehensive effluent treatment. Environmental management systems, environmental licences, environmental reporting and BAT.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 40 h, self-study 93h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I, 488011P Introduction to Process and Environmental Engineering II, 488204S Air Pollution Control Engineering and 488110S Water and Wastewater Treatment recommended before-hand.

Recommended optional programme components:

-

Recommended or required reading:

Material represented in lectures and in the Optima environment.

Assessment methods and criteria:

Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:

University researcher Satu Ojala

Working life cooperation:

No

Other information:

Expert lecturers may be invited from industry to give specific lectures related to the organization.

488206S: Sustainable Energy Project, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

488410A	Introduction to Sustainable Energy	10.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during3 th and 4 th periods

Learning outcomes:

The student is able to adapt the (skills) tools learned in previous courses to complete an energy production and management design project. The student will solve an engineering problem related to sustainable energy generation in cold climate.The student is able to describe the key practical issues related to sustainable energy generation. The student will evaluate the relevant instruments, tools and measures required for sustainable energy production, distribution, and end-use efficiency. The student will demonstrate the ability to select the proper tools, and methods to solve the design problem. The student will also acquire skills to work as a member in an engineering design project as part of a team. He/she will gain the experience to carry out a real project and produce a documentation of the engineering solution.

Contents:

A design project to adapt small-scale renewable energy production and management, greenhouse gas reduction and/or utilization, wind, solar, and geothermal energy generation. Management of energy efficiency. Energy engineering and design principles. Performance evaluation and sustainability assessment of the selected project. Problem solving.

Mode of delivery:

Team work, group meetings and seminars

Learning activities and teaching methods:

Lectures, design projects in small groups, presentations and reporting.

Target group:

Master’s degree students of the degree programmes of Process Engineering and Environmental Engineering

Prerequisites and co-requisites:

The course 488202 Production and Use of Energy is a compulsory, and 488203S Industrial Ecology and 477309S Process and Environmental Catalysis courses are recommended prerequisites to the project

Recommended optional programme components:

-

Recommended or required reading:

Materials delivered on lectures and during the group meetings. *Additional literature:* Manuals and databases, depends on the project work selected.

Assessment methods and criteria:

Written report with the documentation of the engineering solution.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Mika Huuhtanen

Working life cooperation:

No

Other information:

-

477307S: Research Methodology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

480311S	Research Methodology	3.5 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn and spring semesters during periods 1-4.

Learning outcomes:

After the course the student is able to define the role of research and different stages of research work. The student is also able to classify the stages and the subtasks of research work as well as important elements related to research, i.e. literature search, experimental work, and data processing. In addition, the student can evaluate the amount of work needed in research stages. The student can write scientific text and use references appropriately. The student also has the ability to recognise ethical issues related to research and analyse the meanings of those. He/she can use the principles of good scientific practises and is able to apply knowledge to research work.

Contents:

1) Science and research politics. 2) Research education. 3) Fundamentals of philosophy of science. 4) Starting research work: research types, funding, the process of research work, finding the research area, choosing the research topic, information sources. 5) Research plan and collecting data, experimental methods and significance of the variables, systematic experimental design, collecting experimental data, test equipment, reliability of the results, problems in laboratory experiments, modelling and simulation. 6) Mathematical analysis of results. 7) Reporting: writing a scientific text, referring, writing diploma, licentiate and doctoral theses, or reports. 8) Other issues connected to research work: ethical issues, integrity, and future. 9) Examples of scientific research in practice.

Mode of delivery:

Miniproject based on lectures in Optima during autumn term, contact lectures, laboratory training period during spring term.

Learning activities and teaching methods:

Contact lectures 6 h, miniproject 15 h, training period 70 h, self-study 42 h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

None

Recommended optional programme components:

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Recommended or required reading:

Melville, S & Goddard, W: Research Methodology; An Introduction for Science and Engineering Students. Kenwyn 1996, Juta & Co. Ltd. 167 p. Hirsijärvi, S., Remes, P. & Sajavaara, P.: Tutki ja kirjoita. Jyväskylä 2004, GummerusKirjapaino Oy. 436 p. Material introduced in the lectures.
Additional literature : Paradis, J.G. & Zimmermann, M.L.: The MIT Guide to Science and Engineering Communication, 2nd ed. Cambridge 2002, The MITPress, 324 p. Nykänen, O.: Toimivaa tekstiä, Opas tekniikasta kirjoittaville. Helsinki 2002, Tekniikan Akateemisten Liitto TEK. 212 p.

Assessment methods and criteria:

Optima exercises (miniproject) and laboratory training.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Mika Huuhtanen

Working life cooperation:

No

Other information:

The objective of the course is to familiarise the student with scientific research, scientific methods and data handling, especially in process and environmental engineering. The course will give the student the basis to do the research work and motivates him/her to begin post-graduate studies. The course gives the student team working skills and increases the co-operation between the students and the research and teaching staff. The students are exposed to experiences in co-operation between different fields of science, industry, and other universities and laboratories, as well as the skills for doctoral studies.

A431236: Module of the Option/Industrial Engineering, 60 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compolsory

555286A: Process and quality management, 5 op

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Osmo Kauppila

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay555286A	Process and quality management (OPEN UNI)	5.0 op
555281A	Basic Course of Quality Management	5.0 op

ECTS Credits:

5 ECTS credits.

Language of instruction:

Finnish.

Timing:

Period 4.

Learning outcomes:

Upon completion the student is able to explain the role of process and quality management in a business organization. The student is capable of developing business processes based on the principles of quality management and appropriate tools.

Contents:

Foundations of total quality management, planning of quality, performance measurement, process management, people management in relation to quality management, implantation of total quality management.

Mode of delivery:

The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:

20 h lectures, 114 h independent study including tutored group work.

Target group:

Industrial Engineering and Management students and other students studying Industrial Engineering and Management as minor.

Prerequisites and co-requisites:

-

Recommended optional programme components:

This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555285A Project management, 555242A Product development, and 555264P Managing well-being and quality of working life.

Recommended or required reading:

Oakland, J.S. (2014) Total quality management and operational excellence (4th ed.). Routledge, 529 pp. and material handed out during the course.

Assessment methods and criteria:

To pass the course, the student must pass the course exam and complete the classroom exercises and the group work. The course grade is calculated based on the exam and group work grades.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Osmo Kauppila.

Working life cooperation:

No.

Other information:

Substitutes course 555281A Basic Course of Quality Management.

555390S: Statistical Process Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish
Leikkaavuudet:

555380S	Quality Management	5.0 op

ECTS Credits:

5 ECTS credits.

Language of instruction:

Finnish.

Timing:

Period 1.

Learning outcomes:

Upon completion the student can analyze and improve the processes of an organization with the help of statistical tools. The student is able to disseminate the applicability of various statistical tools and methods in different kinds of organizational environments.

Contents:

Processes in an organization from a statistical viewpoint, tools and methods of statistical process control, process improvement using numeric data, stages, challenges and implementation of data analysis, the role of statistical methods in various management philosophies.

Mode of delivery:

The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:

28 h lectures, 105 h independent study on course exercises.

Target group:

Industrial Engineering and Management students and other students studying taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:

555286A Process and Quality Management

Recommended optional programme components:

-

Recommended or required reading:

The study materials will be announced at the beginning of the course.

Assessment methods and criteria:

To pass the course, the student must complete the course exercises and an accompanying course assignment. The course grade is calculated based on the grades of these two course components.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Osmo Kauppila.

Working life cooperation:

No.

Other information:

Substitutes course 555380S Quality Management.

555389S: Systematic Process Improvement, 10 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Osmo Kauppila

Opintokohteen kielet: Finnish

ECTS Credits:

10 ECTS credits.

Language of instruction:

Finnish

Timing:

Periods 1 - 2

Learning outcomes:

Upon completion the student can manage the improvement and problem solving in a process using quality management tools. The student can explain the steps of the DMAIC problem solving model and apply the correct tools for each step. The student is able to apply quality tools into real life process data with the help of MINITAB software and to analyse the results. The student increases his/her understanding of the process type studied in the course exercise.

Contents:

Problem solving using DMAIC, the Six Sigma body of knowledge quality tools, use of MINITAB software, process improvement in practice.

Mode of delivery:

The tuition will be implemented as blended teaching.

Learning activities and teaching methods:

Lectures and related exercises, site visit, a large group exercise related to a process operating in practice.

Target group:

Industrial Engineering and Management students, other students taking Industrial Engineering and Management as minor, postgraduate students.

Prerequisites and co-requisites:

Bachelor in Industrial Engineering and Management or equivalent. Basic knowledge of statistical process control.

Recommended optional programme components:

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Recommended or required reading:

Kubiak, TM & Benbow DW (2009) The Certified Six Sigma Black Belt Handbook, Second Edition. ASQ Quality Press, Milwaukee. 620 s. and material handed out during the course.

Assessment methods and criteria:

To pass the course, the student must complete the group work as an active team member, take part in the course lectures and return the related exercises.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Osmo Kauppila.

Working life cooperation:

-

Other information:

-

Choose 2 courses

555285A: Project management, 5 op

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Kirsi Aaltonen

Opintokohteen kielet: Finnish

Leikkaavuudet:

555288A Project Management 5.0 op
ay555285A Project management (OPEN UNI) 5.0 op
555282A Project Management 4.0 op
555280P Basic Course of Project Management 2.0 op

ECTS Credits:

5 ECTS credits.

Language of instruction:

Finnish. English material may also be used.

Timing:

Period 1.

Learning outcomes:

The objective of the course is to familiarise the student with the basics and the basic methods of project management. Upon completion the student can explain the essential concepts related to project management. He/she can present the main features of a project plan and can use different methods of partitioning a project. The student can also schedule a project and estimate its costs. The student can explain the terms related to Earned value method and can apply the method on simple tasks. Upon completion the student recognizes the essential tasks of project risk management.

Contents:

Defining project management, project planning, organising and scope management, schedule management, cost management, earned value calculation and project risk management, project stakeholder management.

Mode of delivery:

The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:

Lectures or web-based lectures 16h, self-study 118h

Target group:

Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:

No prerequisites exist.

Recommended optional programme components:

This course is part of the 25 ECTS module of Industrial engineering and management that also includes555225P Basics of industrial engineering and management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

Recommended or required reading:

Lecture material, exercise book, Artto, Martinsuo & Kujala 2006. Projektiliiketoiminta. WSOY

Assessment methods and criteria:

The course includes three mandatory assignments, exercise book and exam. The course grading is based on the exam. Well completed assignments and exercise book may raise grading.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Jaakko Kujala.

Working life cooperation:

No.

Other information:

Substitutes courses 555280P Basic Course of Project Management + 555282A Project Management.

555242A: Product development, 5 op

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Haapasalo, Harri Jouni Olavi

Opintokohteen kielet: English

Leikkaavuudet:

ay555242A	Product development (OPEN UNI)	5.0 op
555240A	Basic Course in Product Development	3.0 op

ECTS Credits:

5 ECTS credits**.**

Language of instruction:

English.

Timing:

Period 1.

Learning outcomes:

This course introduces product development and innovations management in a company environment. The course provides fundamental understanding over tools and frameworks that can be used for analysing and managing products, innovations, and technology development. The aim is to create a connection between product development and other company functions. Upon completion of the course a student is capable of explaining the role of product development as a company function. The student understands the difference between innovation activities and systematic product development, and knows the difference between different phases of product development process and its activities. Student learns how to transform customer needs into requirements for product development process and finally into product features. Additionally, the student is able to define the meaning of other company functions to product development activities.

Contents:

Meaning of products for the operations of an industrial enterprise, product development paradigm and defining relevant concepts, realising product development methodologically (U&E model, Cooper's stage-gate model, QFD), managing innovations, and product development success factors.

Mode of delivery:

The tuition will be implemented as blended teaching.

Learning activities and teaching methods:

Lectures 20 h / exercises 6 h / group work and self-study 108 h.

Target group:

Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:

555226A Operations and production.

Recommended optional programme components:

This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555285A Project management, 555264P Managing well-being and quality of working life, and 555286A Process and quality management..

Recommended or required reading:

Handouts, course work, and a collection of articles. Ulrich, K. & Eppinger, S. (2008) Product Design and Development. McGraw-Hill. 358 p.

Assessment methods and criteria:

Assignment and final exam.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail..

Person responsible:

Professor Harri Haapasalo.

Working life cooperation:

No.

Other information:

Substitutes course 555240A Basic Course in Product Development.

555226A: Operations and Production, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Jukka Majava

Opintokohteen kielet: English

Leikkaavuudet:

555222A	Demonstration in Industrial Engineering and Management	2.0 op
555223A	Introduction to Production Control	3.0 op

ECTS Credits:

5 ECTS credits

Language of instruction:

English.

Timing:

Periods 1-2.

Learning outcomes:

Upon completion of the course the student should be able to describe different production types. He/she can apply different forecasting methods, plan needed production capacity, and apply location and transportation decisions related methods. The student can master common inventory management methods and aggregated and short-term scheduling. The student can also create a sales and operations plan for a company.

Contents:

Production types, forecasting methods, capacity planning and queuing models, location and transportation decisions, inventory management systems, aggregate scheduling, MRP & ERP, short-term scheduling, linear programming.

Mode of delivery:

The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:

Lectures 20 h / self-study (web-based exercises) 60 h / group work 54 h.

Target group:

Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:

555225P Basics of industrial engineering and management or similar knowledge.

Recommended optional programme components:

Industrial Engineering and Management students will complete 902143Y English course simultaneously.

Recommended or required reading:

Lecture and exercise materials. Heizer, J. & Render, B. (2014) Operations management: sustainability and supply chain management, 11th ed. Pearson. Krajewski, L.J. et al. (2012) Operations management: processes and supply chains, 10th ed. Pearson.

Assessment methods and criteria:

This course utilizes continuous assessment. During the course, there are mandatory weekly assignments. At least half of the assignments must be passed. 40 % of the grade is based on the group work.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

D.Sc. Jukka Majava.

Working life cooperation:

No.

Other information:

Substitutes course 555222A Demonstration in Industrial Engineering and Management 2 ECTS cr and 555223A Introduction to Production Control 3 ECTS cr.

A431237: Module of the Option/Water and Geo Engineering, 60 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory, choose also 17 ECTS from one of the electives

488133A: Environmental Impact Assessment, 5 op

Voimassaolo: 01.08.2015 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488103A Environmental Impact Assessment 4.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given in the autumn semester, during period 1

Learning outcomes:

The student will acquire a broad and multidisciplinary and sustainable approach to environmental impact assessment (EIA). The student will know the all steps in EIA process and the different methods used in environmental impact assessment. During the course students develop their working life skills (e.g. writing, communication and presentation skills) and the ability to review environmental problems. Thy also learn how to resolve extensive environmental projects related problems, causes and consequences.

Contents:

EIA process and legislation, environmental change, principles and assessment methods in ecology, hydrology, economics and social sciences

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

The course contains lectures (20 h), seminars (9 h) and independent works (106 h)

Target group:

Master students in the Environmental Engineering study program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering I (477011P) and II (488010P)

Recommended optional programme components:

-

Recommended or required reading:

Environmental Impact Assessment: Cutting Edge for the Twenty-First Century (Gilpin A, 1995, ISBN 0-521-42967-6). Lecture hand-outs and other materials delivered in lectures.

Assessment methods and criteria:

The assignement (60 %) and seminar (40%). More information about assessment methods of each module is given during the course.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

The course is arranged in alternate years (even autumn semesters). The course is organised in a co-operation with the Faculty of Technology and the Thule Institute.

488110S: Water and Wastewater Treatment, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisangela Heiderscheidt

Opintokohteen kielet: English

Leikkaavuudet:

480151S	Water and Wastewater Treatment	7.0 op
480208S	Industrial Water and Wastewater Treatment	3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, during period 1

Learning outcomes:

Upon completion of the course, the student will be able to understand the theory and practicalities of the most used processes in water and wastewater treatment. The student will also be capable to perform basic dimensioning calculations and therefore he/she will be able to dimension structures/units of water and wastewater treatment plant processes.

Contents:

Water quality characteristics of source water; basic principles of purification processes (coagulation/flocculation, sedimentation, biological treatment, filtration, disinfection, etc.); used process units in water and waste water treatment; selection of process units; dimensioning of treatment units and unit processes..

Mode of delivery:

Mix of guided self-study work and face-to-face teaching and field visits

Learning activities and teaching methods:

Lectures (20 h), field visits (5 h), exercises ( ), self-study (60 h)

Target group:

Students in the Master program of Environmental Engineering

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering I (477011P) and II (488010P)

Recommended optional programme components:

-

Recommended or required reading:

Lecture hand-outs, & “Lindquist, A., 2003. About water treatment. Helsingborg: Kemira Kemwater”.
Optional: RIL 124-2, Vesihuolto II; Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse; AWWA, Water quality & treatment; AWWA, Water treatment plant design.

Assessment methods and criteria:

The course can be completed: A) Active mode: midterm exam based on reading material + completion of 2 group exercises + final exam based on lectures and exercises; B) BOOK exam: 100% self-study mode where the student is provided with 2-3 reference books and attends an exam based on the provided material.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Researcher Elisangela Heiderscheidt

Working life cooperation:

No

Other information:

-

488108S: Groundwater Engineering, 5 op

Voimassaolo: - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Björn Klöve

Opintokohteen kielet: English

Leikkaavuudet:

480122A	Groundwater Technology	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the spring semester, during period 4

Learning outcomes:

Upon completion of the course, the student will have knowledge on water retention and flow in soils, basic theories about hydraulics of groundwater systems, groundwater quality, groundwater use and modelling. Students learn to define hydraulic characteristics of soil and aquifers. After the course students are able to estimate key factors influencing on discharge and water quality of groundwater and to use general methods to calculate groundwater flow. They also know how to plan, manage, and protect groundwater resources in a sustainable way.

Contents:

Soil and groundwater, water balance, hydraulic properties of soils, formation of groundwater, flow equations and solutions, pumping tests and methods, groundwater quality and modelling.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 10 h, calculus exercises 9 h, MODFLOW modelling exercises 16 h, modelling report 40 h, and self-study 60 h

Target group:

Master students in the Water Engineering study options of the Environmental Engineering program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes

Recommended optional programme components:

-

Recommended or required reading:

Lecture handouts, Physical and Chemical Hydrogeology (Domenico PA, Schwartz FW, 2nd edition, 1998, ISBN 0-471- 59762-7). Maanalaiset vedet - pohjavesigeologi-an perusteet (Korkka-Niemi K, Salonen V-P, 1996, ISBN 951-29-0825-5). Pohjavesi ja pohjaveden ympäristö (Mälkki E, 1999, ISBN 951-26-4515-7).

Assessment methods and criteria:

Modelling assignment (40 % of the grade) and exam (60 % of the grade).
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Postdoctoral Researcher Pekka Rossi

Working life cooperation:

No

Other information:

-

488127S: Field measurements, site investigations and geotechnical tests, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given during periods 1 and 2

Learning outcomes:

Upon completion the student should be able to design field measurements and understand the quality of sampling and measurements in the field of environmental engineering. The student also improves skills of working in a team of fellow students to share expertise and execution responsibilities. The student understands the laboratory testing procedures and the associated parameters that help in estimating the soil mechanics and Geotechnical engineering and. The student knows how to use different methods for field measurement and sampling in water and geotechnical issues. The student can take considering the safety during the laboratory works and field measurements. After the course, the student can write detailed engineering reports.

Contents:

In the lectures: Units of measurements, Error and mistake in laboratory works and field measurements, random and systematic error, precision and accuracy in laboratory work, planning field works, description of measuring site, Securing results and material, sample preservation, subsoil exploration, direct & indirect methods of exploration, disturb and undisturbed samples, Safety in field work, introduction on surveying, leveling, map and scale.
In laboratory: Laboratory works on Geotechnical and Geoenvironmental Engineering contain sieving test, hydrometer test, Atterberg limits test, proctor test, direct shear box test and eudiometer test. Field measurement experiences in cold climate.
In the field: Working with GPS. Levelling and collecting data for preparing topography map. Soil and water sampling. Ground water sampling. Measuring velocity and discharge of river.

Mode of delivery:

Face-to-face teaching, laboratory working

Learning activities and teaching methods:

Activating learning method: Lectures (15 h), group work (120 h)

Target group:

Master students in the Water and Geo Engineering and Water and Environment study options

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit:
488115A Geomechanics

Recommended optional programme components:

-

Recommended or required reading:

Field measurements and Laboratory work instruction, lecture materials

Assessment methods and criteria:

Each exercise is evaluated graded on the scale 1-5. The final grade of the course is weighted average of following parts: participate in the lectures (5%), participate in the laboratory and field works (20% if the respective report will be presented), assignments (8%), and reports (50%), Exam (15%).

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Teacher Ali Torabi Haghighi

Working life cooperation:

No

Other information:

-

488128S: Laboratory tests in water resources engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given during the spring periods 3 and 4

Learning outcomes:

Upon completion this course, the student improves their skills of working in a team of fellow students to share expertise and execution responsibilities. The student understands the laboratory testing procedures and the associated parameters that help in estimating the water, and waste water properties. The laboratory work contains 3 main parts: fluid mechanics and open channel, water and waste water and ground water engineering.

Contents:

In the lectures: Units of measurements, error and mistake in laboratory works, how to write lab report, safety in laboratory, calibration, introduction to laboratory test in fluid mechanics and open channel hydraulics, introduction to laboratory tests in water and waste water engineering and introduction to groundwater engineering.
In laboratory: Laboratory works on Fluid mechanics and open channel hydraulics contain different method for discharge measurement, Bernoulli equation, Momentum equation, reservoir outflow, Pump and pumping, gates and wires, hydraulic jump and tracer test. Laboratory works on Ground water engineering contain hydraulic conductivity (K), specific yield (S), porosity (n) and PF curve test, Darcy low and groundwater flow, contaminant transport. Laboratory works on water and waste water engineering contain Jar test experiment, settling velocity, limestone ($CaCO_3$) filtration, aeration determination of Fe, Cl^-, Mn.

Mode of delivery:

Face-to-face teaching, laboratory working

Learning activities and teaching methods:

Activating learning method: Lectures (10 h), group work (120 h)

Target group:

Master students in the Water and Geo Engineering and Water and Environment study options

Prerequisites and co-requisites:

The required prerequisite is the completion of the following courses prior to enrolling for the course unit: 488102 Hydrological Processes, 488108S Groundwater Engineering, 488110S Water and Wastewater Treatment, 488113S Introduction to Surface Water Quality Modelling

Recommended optional programme components:

-

Recommended or required reading:

Field measurements and Laboratory work instruction, lecture materials

Assessment methods and criteria:

Each exercise is evaluated graded on the scale 1-5. The final grade of the course is weighted average of following parts participate in the lectures (5%), participate in the laboratory (20% if the respective report will be presented), assignments (10%), and reports (50%), Exam (15%).

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Teacher Ali Torabi Haghighi

Working life cooperation:

No

Other information:

-

488121S: Fundamentals of Civil Engineering, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kauko Kujala

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course unit is held in the autumn semester, during period 1

Learning outcomes:

The student knows how to calculate stability and settlement of municipal earth structures, design the structures against frost depth and frost heave and evaluate the needs for soil improvement. The student knows risks of the excavations and slopes and can design those using mathematical theories.

Contents:

Norms and instructions, basis of geotechnical design, earth and road structures, properties of soil material and industrial by-products, slope stability, settlement calculations, soil improvement, excavations, frost depth and frost heave calculation, thaw settlement, dams and tailings, landfill bottom

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (34 h) and design and calculation exercises (10 h) also self-study (90 h)

Target group:

Master students in the Water and Geo Engineering study option of the Environmental Engineering program

Prerequisites and co-requisites:

488115A Geomechanics, 488102A, Hydrological processes, 477032A AutoCAD and Matlab in process and environmental engineering

Recommended optional programme components:

-

Recommended or required reading:

Handout and other materials delivered in lectures

Assessment methods and criteria:

Examination and homeworks
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Kujala

Working life cooperation:

No

Other information:

-

488105A: Water Supply Networks, 5 op

Voimassaolo: 01.08.2005 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: Finnish

Leikkaavuudet:

480120A	Water Distribution and Sewerage Networks	3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course unit is given in the spring semester, in period 3

Learning outcomes:

Student knows and understands those systems what are needed for water distribution and waste water and storm water collection. Student is able to do basic dimensioning for water distribution network and sewer system of population centre.

Contents:

Water and drainage pipe design and dimensioning. Pumping and storage tanks needed in distribution of water and collection of sewage water. Control and automation of pumping stations. Observations in pipelines to prevent corrosion, effects of cold climate and harmful hydraulic impacts.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (30 h), homeworks (45 h) and a design exercise (60 h). Total 135 h.

Target group:

Students in master programs of environmental engineering

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the following course prior to enrolling for the course unit: 488010P Introduction to Environmental Engineering II, 477052A Fluid Mechanics, and 477312A Heat and Mass Transfer, or equivalent information about water management.

Recommended optional programme components:

This course is followed by 488125S Water and Wastewater Networks, Advanced Course

Recommended or required reading:

Lecture handout and other materials delivered in lectures. To the appropriate extent: RIL 237-1-2010 Vesihuolto-verkkojen suunnittelu, RIL 237-2-2010 Vesi-huoltoverkkojen suunnittelu, RIL 124-2 Vesihuolto II, Mays Water distribution systems handbook.

Assessment methods and criteria:

Examination and a design exercise.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Postdoctoral Researcher Pekka Rossi

Working life cooperation:

No

Other information:

-

488117S: Water Resources Management, 5 - 7,5 op

Voimassaolo: - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannu Marttila, Ali Torabi Haghighi

Opintokohteen kielet: English

Leikkaavuudet:

480170S Environmental Impact Assesment and Diminishing Harmful Effects in Water Resource Management 5.0 op

480212S Environmental Construction 3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, during period 2

Learning outcomes:

This course introduces design concepts and principles that must be taken into account in planning of sustainable use of water resources. After the course students understand different processes, principles and mathematical methods used to manage water resources issues.

Contents:

Different water uses and interests, hydropower and dam engineering, irrigation and drainage, flood control and management, river restoration cases, sediment transport problems, peatland

land use, acid sulphate soils, optimization and simulation, lake restoration, socio-ecological aspects in water resources.

Mode of delivery:

Face-to-face teaching, assignments

Learning activities and teaching methods:

Variable learning methods: Lectures and assignments

Target group:

Master students in the water engineering study options of Environmental Engineering program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes

Recommended optional programme components:

-

Recommended or required reading:

Water Resources Systems Planning and Management: An Introduction to Methods, Models and Applications. (Loucks and van Beek, 2005, ISBN 92-3-103998-9)

Assessment methods and criteria:

Variable assessment methods where each submission is graded and weighted separately: Assignment 1 (30%), Assignment 2 (20%) and Assignment 3 (50%). More detailed instructions will be given in the course. Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

D.Sc. (Tech.) Hannu Marttila

Working life cooperation:

No

Other information:

The course is arranged in alternate years (odd autumn semesters)

Water Engineering

488122S: Statistical Methods in Hydrology, 5 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Björn Klöve, Hannu Marttila

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, during period 2

Learning outcomes:

By completing the course, students will be able to understand and apply most common statistical methods used in hydrology. Students gain experience in using statistical software to solve problems for large hydrological datasets. With the software, students can present their findings with various plots which are conventional in statistical hydrology and water resources management. During the course students will be further familiarized with scientific writing and reporting.

Contents:

Course uses hydrological and meteorological data to cover topics:1) Summary statistics like mean, maximum, minimum, median, standard deviation and etc. 2) Probability distributions (normal, gamma, log-normal and generalized extreme value) visualized with histograms, box plots, and CDF's and used in recurrence analyses. 3) Analyzing statistical significance of correlations between hydrological and meteorological variables. 4) Building and visualizing regression models and estimating the validity of the established models. 5) Trend and time series analysis using plots and statistical autoregression models.

Mode of delivery:

Face-to-face teaching, independent assignments

Learning activities and teaching methods:

In total, 135 hours of learning activities consisting of lectures (9 h), instructed computer sessions (18 h), and return assignments (108 h)

Target group:

Master students in the water engineering study options of the Environmental Engineering program

Prerequisites and co-requisites:

The prerequisite is the completion of the following courses: 488102A Hydrological Processes, and 477033A Programming in Matlab or corresponding Matlab skills

Recommended optional programme components:

-

Recommended or required reading:

Helsel, D.R., & Hirsch, R.M., 2002. Statistical Methods in Water Resources (available online). Loucks, D. P., van Beek, E., Stedinger, J.R., Dijkman J.P.M., Villars, M.T., 2005. Water Resources Systems Planning and Management (available online).

Assessment methods and criteria:

A) reports of group work on 3 return assignments (each 25% of the final grade), and B) final exam (25% of the final grade))
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Final grade of the course is average of assignments and final exam. In the numerical scale zero stands for a fail.

Person responsible:

Professor Björn Klöve

Working life cooperation:

No

Other information:

The course is arranged in alternate years (odd autumn semesters)

488124S: Advanced Course in Hydrology, 5 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Björn Klöve

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given in the autumn semester, during period 1

Learning outcomes:

In-depth knowledge on hydrology

Contents:

Hydrological processes, evapotran-spiration, climate variability and extreme events, rainfall-runoff modeling, isotope hydrology

Mode of delivery:

Face-to-face teaching and independent work with assignments

Learning activities and teaching methods:

Guided and independent process studies and modelling

Target group:

Master students in the water engineering study options of Environmental Engineering program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes, 488122S Statistical Methods in Hydrology

Recommended optional programme components:

-

Recommended or required reading:

Delivered during the course

Assessment methods and criteria:

-

Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Björn Klöve

Working life cooperation:

No

Other information:

The course is arranged in alternate years (even autumn semesters)

488113S: Basics of surface water quality modelling, 5 op

Voimassaolo: - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Anna-Kaisa Ronkanen

Opintokohteen kielet: English

Leikkaavuudet:

480210S	Environmental Impacts of Industrial Effluents	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given in the autumn semester, during period 2

Learning outcomes:

The student knows the main transport mechanisms and will be able to model water quality in lakes and streams. The students will be able to use Matlab in environmental analysis, modeling and programming.

Contents:

Introduction to modelling in water resources planning, environmental hydraulics, open channel flow, lake hydraulics, processes and water quality, dimensional analysis, hydraulic experiments, transport of conservative and reactive solutes in rivers. Modelling with ordinary differential equations, fully mixed systems, analytical and numerical methods for surface water modelling. Parameter estimation and uncertainty.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 25 h, exercises by Matlab 16 h, self-studies 94 h. Totally 135 h.

Target group:

Master students in the water engineering study options of the Environmental Engineering program

Prerequisites and co-requisites:

Basic university level knowledge of mathematics and physics is required. The required prerequisite is also the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes

Recommended optional programme components:

Matlab courses are recommended before the course unit

Recommended or required reading:

Surface Water Quality Modelling (Chapra S, 1996, ISBN 0-0701-1-364-5). Fluvial Hydraulics: Flow and Transport Processes in Channels of Simple Geometry. (Walter HG, 1998, ISBN 0-0471-97714-4). Environmental Hydraulics of Open Channel Flows (Chanson H, 2004, ISBN 0-7506-6165-8). Lecture hand-outs and other materials delivered in lectures.

Assessment methods and criteria:

Totally 4 assignments and examination must be done and are graded on the scale 1-5. The final grade of the course is average grade of them.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

The course is arranged in alternate years (even autumn semesters).

488123S: River Engineering and Hydraulic Structures, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ali Torabi Haghighi

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester during period 2

Learning outcomes:

Upon completion the student should be able to applied the pervious learned courses (open channel Hydraulics, fluid mechanics and hydrology) in hydraulic structures design and river engineering, cclassify the hydraulic structures, purposes and functions of them and design hydraulic structures using river analysis software. The student knows structures for flood protection.

Contents:

Review of hydrology, open channel hydraulics and fluid mechanics, General Requirements and Design Considerations, River geomorphology and river engineering, Flood, managing and damage assessment, Erosion and sediment transport in river, River analysis system by using Hec-Ras, River stability and flood control structure Conveyance structures, Water storage structures, Protective structures, Regulating structures, Water measurement structures, Energy Dissipaters, Hec-Ras software in hydraulic structure design.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Activating learning method: Lectures (24 h), group work (35 h), independent work (30 h), self-study (40 h) and seminar (3 h)

Target group:

Master students in the water engineering study options of the Environmental Engineering program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes

Recommended optional programme components:

The course 488113S Introduction to Surface Water Quality Modelling is recommended to take before this course unit

Recommended or required reading:

Novak, P., Moffat, A. Nalluri, C. and Narayanan, R., Hydraulic Structures, 3rd ed., 2001. U.S. Bureau of Reclamation, Design of Small Dams, U.S. Government Office, 1987. U.S. Bureau of Reclamation, Design of Small canal structures, U.S. Government Office, 1974. Lecture hand-outs.

Assessment methods and criteria:

Modelling with river analysis software and technical project (40%), assignment (30%), river engineering report (30%)
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Björn Klöve and University Teacher Ali Torabi Haghighi

Working life cooperation:

No

Other information:

The course is organised every second year (on even autumn terms)

488131S: Geoenvironmental Engineering, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kauko Kujala

Opintokohteen kielet: Finnish

Leikkaavuudet:

485306S	Geoenvironmental Engineering	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course unit is held in the autumn semester during period 1

Learning outcomes:

The student knows norms and instruction which are related to contaminated sites. The students can choose the suitable remediation of contaminated soil. The student can calculate contaminant transport in soils. The student can also design geotechnical structures of industrial and domestic landfills and evaluate the needs for remediation of contaminated soils. Student know how to used by-products from industry in different applications.

Contents:

Norms and instructions, there will be a project work where student will be discover a contaminated soil and a proposal remediation technique, Properties of soil material and industrial by-products, basis of geotechnical design to landfill environment, challenges of mining

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (44 h), group work (60 h) and independent work (30 h)

Target group:

Master students in the study option of Water and Geo Engineering

Prerequisites and co-requisites:

488115A Geomechanics

Recommended optional programme components:

-

Recommended or required reading:

Handout and other materials delivered in lectures

Assessment methods and criteria:

Written exam and exercises
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Anne Tuomela

Working life cooperation:

No

Other information:

-

Geo Engineering; you may also choose 488131S Geoenvironmental Engineering and 488123S River Engineering and Hydraulic Structures

488111S: Modelling in Geoenvironmental Engineering, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

485305S	Modelling in Geoenvironmental Engineering	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course unit is given in the spring semester, during period 4

Learning outcomes:

After the course the student can apply the numerical calculation methods in design and dimensioning of earth and geoenvironmental structures. The student can evaluate the influence of boundary conditions and material parameters in calculation results.

Contents:

Contaminant transport. Design and dimensioning of piles, tailings and dams structures. Settlement calculation due to different load types. Calculating the earth pressure of retaining walls. Freezing and thawing of earth structures.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (10 h), design and modelling assignments (58 h), self-studies (60 h)

Target group:

Master's students in the study option of Water and Geoenvironmental Engineering

Prerequisites and co-requisites:

488115A Geomechanics, 488102A, Hydrological processes, 477032A AutoCAD and Matlab in process and environmental engineering

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout and other materials delivered in lectures

Assessment methods and criteria:

Solving the given assignments and writing reports about them.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Pass/fail

Person responsible:

University teacher Anne Tuomela

Working life cooperation:

No

Other information:

-

460163S: Foundation Engineering, 5 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Liedes, Hannu Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

466104S	Foundation engineering	5.0 op

Ei opintojaksokuvauksia.

488132S: Cold Climate Engineering, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kauko Kujala

Opintokohteen kielet: English

Leikkaavuudet:

485307S	Cold Climate Engineering	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Period 3, spring term

Learning outcomes:

By completing the course the student is able to take into account cold and arctic conditions in design, dimension and construction of civil engineering structures.

Contents:

Renewable energy principles in cold climate, arctic civil engineering and environmental protection. Thermal properties of snow, ice and soils. Coupled mass and heat transfer in soil. Frost action in soils, frost depth, frost heave and thaw consolidation. Mechanical properties of frozen soil, bearing capacity of ice. Thermal insulation of engineering structures in cold climate. Foundations in permafrost. Thawing problems of permafrost.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Face-to-face teaching 44 h including exercises

Target group:

Master students in the Water and Geo Engineering and Water and Environment study options

Prerequisites and co-requisites:

Courses (or respective knowledge): Hydrological Processes, Geomechanics, Fluid Mechanics, Heat and Mass Transfer

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes, Andersland & Andersson: Geotechnical Engineering for Cold Regions, CREEL: Snow Mechanics, CREEL report 97-3, US Army Corps of Engineers.

Assessment methods and criteria:

Exam and exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Kujala

Working life cooperation:

No

Other information:

The course will be arranged first time in year 2016

477005S: Advanced Practical Training, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Practical training

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

485002S	Advanced Practical Training	5.0 op
488002S	Advanced Practical Training	3.0 op
477002S	Advanced Practical Training	3.0 op

ECTS Credits:
5 ECTS**,** 2 months working full-time
Language of instruction:
Finnish or English
Timing:
Student usually works during the summer time
Contents:
During the practical training the student will acquaint themselves with the working environment from the point of view of his/her studies and with another possible future job, or with a different assignment already in a familiar working environment. He/she can identify the problems of the working environment and can solve them. The student can apply his/her theoretical knowledge in practical tasks. He/she identifies the tasks appropriate for the Master of Science in Technology at his/her workplace.
Mode of delivery:
Working as employee
Learning activities and teaching methods:
Students will find the training positions themselves. Suitable areas for practical training are, for example, regional environment centers, environmental engineering and consulting offices, water-works, biotechnological and food industry, chemical industry, pulp and paper industry, metallurgical and mining industry, partly electronics and automation industry, and other areas in the private and public sectors.
Target group:
Master's students in Process and Environmental Engineering
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
-
Assessment methods and criteria:

Practical training, seminar presentation reporting their summer job. Student has to present his/her original references and submit an application form to the supervisor of the seminar. The reference must include the training period (from - to) and the duties.

Grading:

Verbal scale Passed/Failed

Person responsible:

Student councellor Saara Luhtaanmäki

Working life cooperation:

Yes

Other information:

The objective is to get a deeper and more detailed conception of the industrial area where the student will possibly work after graduation. Suitable tasks would be supervision tasks and R&D tasks.

A431252: Supplementary Module, Material Engineering, 29,5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

470313S: Maturity Test / Process Engineering, 0 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

A432123: Basic Studies, Environmental Engineering, 70 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Basic Studies

477011P: Introduction to Process and Environmental Engineering I, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Sanna Taskila, Aki Sorsa

Opintokohteen kielet: Finnish

Leikkaavuudet:

470219A	Introduction to Process Engineering	3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Implementation during periods 1-2 on the autumn term

Learning outcomes:

The objective of this course is to give insight to the whole perspective of process and environmental engineering and to familiarise the students with the terminology involved. In addition, the objective is also to outline the connections between process and environmental engineering and other fields closely related to them.
After the course, the student can analyse the process and environmental engineering aspects of an industrial process. He/She can, for example, divide the process into unit processes, analyse the process or a chain of processes based on the material balances, identify and evaluate the significance of essential mechanical, chemical and transport phenomena, analyse the control and process design aspects of a process etc. He/She can also evaluate the significance of different aspects of process and environmental engineering to the overall production system when these aspects are further examined in forthcoming courses.

Contents:

The course is divided into the next eight separate themes: 1. Unit processes and material balances. 2. Environmental impacts and their classification. 3. Mechanical phenomena. 4. Momentum, heat and mass transfer phenomena. 5. Chemical reactions and reactors. 6. The possibilities of biological process engineering. 7. Process dynamics and control. 8. Process measurements and measurability.

Mode of delivery:

Group work and contact lectures supporting those

Learning activities and teaching methods:

Assignments (8 altogether) carried out in small groups and contact lectures supporting them (16 hours)

Target group:

Bachelor’s degree students in the study fields of process and environmental engineering

Prerequisites and co-requisites:

None

Recommended optional programme components:

The course serves as an introduction to the studies in process and environmental engineering

Recommended or required reading:

The material is provided during the contact lectures and through the course webpages. It is also expected that the students seek material for completing the assignments independently.

Assessment methods and criteria:

The assignments (altogether 8) covering the course themes carried out in small groups.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilises a numerical grading scale 1-5 and fail.

Person responsible:

Dr Aki Sorsa

Working life cooperation:

No

Other information:

The assessment method utilized requires the active attendance to the group work and contact lectures from the beginning of the course

488010P: Introduction to Process and Environmental Engineering II, 5 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Fabritius, Timo Matti Juhani
Opintokohteen kielet: Finnish
Leikkaavuudet:

488011P	Introduction to Environmental Engineering	5.0 op
477012P	Introduction to Automation Engineering	5.0 op

ECTS Credits:

5 cr / 135 hours of work

Language of instruction:

Available only in Finnish

Timing:

The course is given in the spring semester, during periods III and IV. It is recommended to complete the course at the 1st spring semester.

Learning outcomes:

Students can examine industrial processes using the methods and perspectives of process and environmental engineering (e.g. material management, phenomenon-based considerations and automation) and they recognize the role of different areas of the process and environmental engineering, when these areas are considered in the forthcoming courses.

Contents:

1. Environmental thinking and industrial ecology. 2. Materials in production processes. 3. Water resources and land use. 4. Municipal and industrial water supply. 5. PI diagrams. 6. Process design. 7. Control and operation of processes.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Group exercises and contact-education (14 h) that supports these exercises. Available only in Finnish.

Target group:

Students of process and environmental engineering

Prerequisites and co-requisites:

None

Recommended optional programme components:

This course is an introduction to the other courses of process and environmental engineering

Recommended or required reading:

Material will be distributed during lectures and via course www-site

Assessment methods and criteria:

Group exercises. Please note that the course is not available in English, but only in Finnish.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Timo Fabritius

Working life cooperation:

No

Other information:

It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun.

031010P: Calculus I, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Ilkka Lusikka

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay031010P	Calculus I (OPEN UNI)	5.0 op

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Autumn semester, periods 1-3.

Learning outcomes:

After completing the course the student identifies concepts of vector algebra and can use vector algebra for solving problems of analytic geometry. The student can also explain basic characteristics of elementary functions and is able to analyse the limit and the continuity of real valued functions of one variable. Furthermore, the student can solve problems associated with differential and integral calculus of real valued functions of one variable.

Contents:

Vector algebra and analytic geometry. Limit, continuity, differential and integral calculus and applications of real valued functions of one variable. Complex numbers.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 55 h / Group work 22 h.

Target group:

-

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Grossmann, S.I.: Calculus of One Variable; Grossmann, S.I.: Multivariable Calculus, Linear Algebra and Differential Equations (partly); Adams, R.A.: A Complete Course Calculus (partly).

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

031075P: Calculus II, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Ilkka Lusikka

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay031075P	Calculus II (OPEN UNI)	5.0 op
031011P	Calculus II	6.0 op

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Spring, period 3

Learning outcomes:

The course gives the basics of theory of series and differential and integral calculus of real and vector valued functions of several variables. After completing the course the student is able to examine the convergence of series and power series of real terms. Furthermore, the student can explain the use of power series e.g. in calculating limits and is able to solve problems related to differential and integral calculus of real and vector valued functions of several variables.

Contents:

Sequences, series, power series and Fourier series of real terms. Differential and integral calculus of real and vector valued functions of several variables.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h / Group work 28 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the course Calculus I.

Recommended optional programme components:

-

Recommended or required reading:

Kreyszig, E.: Advanced Engineering Mathematics; Grossmann, S.I.: Multivariable Calculus, Linear Algebra and Differential Equations.

Assessment methods and criteria:

Intermediate exams or a final exam.

Grading:

Numerical grading scale 1-5.

Person responsible:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

031076P: Differential Equations, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay031076P Differential Equations (OPEN UNI) 5.0 op
800320A Differential equations 5.0 op
031017P Differential Equations 4.0 op

Ei opintojaksokuvauksia.

031078P: Matrix Algebra, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Matti Peltola
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay031078P Matrix Algebra (OPEN UNI) 5.0 op
031019P Matrix Algebra 3.5 op

Ei opintojaksokuvauksia.

031021P: Probability and Mathematical Statistics, 5 op

Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Kemppainen
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay031021P Probability and Mathematical Statistics (OPEN UNI) 5.0 op

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Spring semester, periods 4-6

Learning outcomes:

After completing the course the student knows the key concepts of probability and the most important random variables and is able to use them in calculating probabilities and parameters of probability distributions. In addition, the student is able to analyze statistical data by calculating interval and point estimates for the parameters. The student is also able to formulate statistical hypotheses and test them.

Contents:

The key concepts of probability, random variable, parameters of probability distributions, estimation of parameters, hypothesis testing.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 44 h/Exercises 22 h/Self-study 68 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisites are the course 031010P Calculus I and some parts of the course 031011P Calculus II.

Recommended optional programme components:

-

Recommended or required reading:

Milton, J.S., Arnold, J.C. (1992): Introduction to Probability and Statistics.

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Jukka Kemppainen

Working life cooperation:

-

Other information:

-

761111P: Basic mechanics, 5 op

Voimassaolo: 01.01.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761118P	Mechanics 1	5.0 op
761118P-02	Mechanics 1, lab. exercises	0.0 op
761118P-01	Mechanics 1, lectures and exam	0.0 op
ay761111P	Basic mechanics (OPEN UNI)	5.0 op
761101P	Basic Mechanics	4.0 op

ECTS Credits:

5 credits

Language of instruction:

The lectures will be in Finnish. The textbook is in English and exercises are selected from the textbook. For further information, contact the responsible person of the course.

Timing:

Autumn

Learning outcomes:

The student is able to describe the basic concepts of mechanics and to apply those when solving the problems related to mechanics.

Contents:

We encounter many phenomena related to mechanics in our everyday life. Most engineering sciences are based on mechanics and mechanics forms the basis of many other fields of physics, including modern physics.
Contents in brief: Short summary of vector calculus. Kinematics, projectile motion and circular motion. Newton's laws of motion. Work and different forms of energy. Momentum, impulse and collisions. Rotational motion and moment of inertia. Torque and angular momentum. Rigid body equilibrium problems. Gravitation. Periodic motion. Fluid mechanics.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 32 h, 8 exercises (16 h), 2 laboratory exercises (8 h), self-study 77 h

Target group:

For the students of the University of Oulu

Prerequisites and co-requisites:

Knowledge of vector calculus and basics of differential and integral calculus

Recommended optional programme components:

No alternative course units or course units that should be completed simultaneously

Recommended or required reading:

Text book: H.D. Young and R.A. Freedman: University physics, Addison-Wesley, 13th edition, 2012, chapters 1-14. Also older editions can be used.
Lecture material: Finnish lecture material will be available on the web page of the course.
Course material availability can be checked here.

Assessment methods and criteria:

Three mini examinations and end examination or final examination
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Anita Aikio

Working life cooperation:

No work placement period

Other information:

https://noppa.oulu.fi/noppa/kurssi/761111P/etusivu

Compulsory

761111P-01: Basic mechanics, lectures and exam, 0 op

Voimassaolo: 01.01.2015 -

Opiskelumuoto: Basic Studies

Laji: Partial credit

Vastuuyksikkö: Field of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761118P-01 Mechanics 1, lectures and exam 0.0 op

761118P-02 Mechanics 1, lab. exercises 0.0 op

761101P Basic Mechanics 4.0 op

Ei opintojaksokuvauksia.

761111P-02: Basic mechanics, lab. exercises, 0 op

Voimassaolo: 01.01.2015 -

Opiskelumuoto: Basic Studies

Laji: Partial credit

Vastuuyksikkö: Field of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761118P-01 Mechanics 1, lectures and exam 0.0 op

761118P-02 Mechanics 1, lab. exercises 0.0 op

761101P Basic Mechanics 4.0 op

Ei opintojaksokuvauksia.

761113P: Electricity and magnetism, 5 op

Voimassaolo: 01.01.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761119P Electromagnetism 1 5.0 op

761119P-01 Electromagnetism 1, lectures and exam 0.0 op

761119P-02 Electromagnetism 1, lab. exercises 0.0 op

766319A Electromagnetism 7.0 op

761103P Electricity and Magnetism 4.0 op

ECTS Credits:

5 credits

Language of instruction:

The lectures will be in Finnish. The textbook is in English and exercises are selected from the textbook. For further information, contact the responsible person of the course.

Timing:

Spring

Learning outcomes:

The student is able to describe the basic concepts of electricity and magnetism and to apply those when solving the problems related to electromagnetism.

Contents:

Electromagnetic interaction is one of the four fundamental interactions in physics and many phenomena like light, radio waves, electric current, magnetism and formation of solid matter are based on electromagnetism. The current technological development is largely based on applications of electromagnetism in energy production and transfer, telecommunications and information technology.

Contents in brief: Coulomb's law. Electric field and potential. Gauss's law. Capacitors and dielectrics. Electric current, resistors, electromotive force and DC circuits. Magnetic field, motion of a charged particle in electric and magnetic fields, and applications. Ampère's law and Biot-Savart law. Electromagnetic induction and Faraday's law. Inductance and inductors. R-L-C circuits, alternating current and AC circuits.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 32 h, 6 exercises (12 h), 2 laboratory exercises (8 h), self-study 81 h

Target group:

For the students of the University of Oulu.

Prerequisites and co-requisites:

Knowledge of vector calculus and basics of differential and integral calculus are needed.

Recommended optional programme components:

No alternative course units or course units that should be completed simultaneously

Recommended or required reading:

Text book: H.D. Young and R.A. Freedman: University physics, Addison-Wesley, 13th edition, 2012, chapters 21-31. Also older editions can be used.
Lecture material: Finnish lecture material will be available on the web page of the course.
Course material availability can be checked here.

Assessment methods and criteria:

Three mini examinations and end examination or final examination
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Anita Aikio

Working life cooperation:

No work placement period

Other information:

https://wiki.oulu.fi/display/761113P/

Compulsory

761113P-01: Electricity and magnetism, lectures and exam, 0 op

Voimassaolo: 01.01.2015 -
Opiskelumuoto: Basic Studies
Laji: Partial credit
Vastuuyksikkö: Field of Physics
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

761119P Electromagnetism 1 5.0 op
761119P-01 Electromagnetism 1, lectures and exam 0.0 op
761119P-02 Electromagnetism 1, lab. exercises 0.0 op
766319A Electromagnetism 7.0 op
761103P Electricity and Magnetism 4.0 op
761121P Laboratory Exercises in Physics 1 3.0 op

Ei opintojaksokuvauksia.

761113P-02: Electricity and magnetism, lab. exercises, 0 op

Voimassaolo: 01.01.2015 -
Opiskelumuoto: Basic Studies
Laji: Partial credit
Vastuuyksikkö: Field of Physics
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

761119P Electromagnetism 1 5.0 op
761119P-01 Electromagnetism 1, lectures and exam 0.0 op
761119P-02 Electromagnetism 1, lab. exercises 0.0 op
766319A Electromagnetism 7.0 op
761103P Electricity and Magnetism 4.0 op

Ei opintojaksokuvauksia.

780117P: General and Inorganic Chemistry A, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Field of Chemistry
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay780117P General and Inorganic Chemistry A (OPEN UNI) 5.0 op

ECTS Credits:

5 credits /134 hours of work

Language of instruction:

Finnish

Timing:

1st autumn

Learning outcomes:

After this course the student should understand basic concepts of chemistry as described in international general chemistry curriculum.

Contents:

Basic concepts of chemistry, chemical formula, chemical reaction, chemical equation, oxidation-reduction reactions, stoichiometry, gases, chemical equilibrium, acids and bases, additional aspects of acid-base equilibria, solubility and complex-ion equilibria.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

32 hours of lectures and applications, 20 hours of exercises and 82 hours of self-study

Target group:

Biochemistry, Chemistry, Biology, Geology, Mechanical Engineering, Process Engineering, Environmental Engineering compulsory. In the entity of 25 credits (minor studies), compulsory. Physical sciences, Mathematical sciences, optional.

Prerequisites and co-requisites:

Upper secondary school chemistry

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Petrucci, R.H., Herring, F.G., Madura, J.D. ja Bissonnette, C.: General Chemistry: Principles and Modern Applications, 10. edition (also 7., 8. and 9. edition), Pearson Canada Inc., Toronto, 2011. Chapters 1 – 6, 15 – 18.

Assessment methods and criteria:

Two intermediate examinations or one final examination Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

Person responsible:

Lecturer Leena Kaila

Working life cooperation:

No

Other information:

No

780116P: Introduction to Organic Chemistry, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Chemistry

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay780116P	Introduction to Organic Chemistry (OPEN UNI)	5.0 op

ECTS Credits:

5 credits /134 hours of work

Language of instruction:

Finnish. Book-examination in English as well.

Timing:

1st autumn and 1st spring

Learning outcomes:

After this course, the student can explain organic chemistry fundamentals, basic concepts and terminology, can use them for the description of organic chemistry phenomena. He/she can name organic structures, explain their properties, deduce basic reaction types and solve their mechanisms.

Contents:

Basic reactions of organic compounds, basic principles of stereochemistry and reaction mechanisms: Addition, elimination, substitution, including electrophilic aromatic substitution, reactions of carbonyl group. Applications.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

42 hours of lectures plus 12 hours of exercises, 80 hours of independent self-study

Target group:

Biochemistry, Chemistry, Biology, Process Engineering, Environmental Engineering and in the study entity of 25 credits, compulsory. Physical Sciences, Geology, Geograhpy, Mathematical Sciences, optional.

Prerequisites and co-requisites:

Upper secondary school chemistry

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Hart, H., Hart, D.J. and Craine, L.E.: Organic Chemistry: A Short Course, 10 th ed. or the newer edition, Houghton Mifflin Boston, 1999; Hart, H., Hart, D.J. and Craine, L.E.: Study Guide & Solutions Book, Organic Chemistry: A Short Course, 10th ed. or the newer edition, Houghton Mifflin Boston, 1999.

Assessment methods and criteria:

Two intermediate examinations or one final examination Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 0-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr. Johanna Kärkkäinen

Working life cooperation:

No

Other information:

No

780123P: Introductory Laboratory Works in Chemistry, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Chemistry

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

5 credits /134 hours of work

Language of instruction:

Finnish

Timing:

1st autumn or 1st spring

Learning outcomes:

After this course, the student can apply laboratory safety instructions and act accordingly. He/she can communicate by using basic laboratory terminology and work in a group under the guidance. The student identifies basic laboratory equipment and can use them properly. He/she recognizes the importance of the planning of the laboratory work. The student is able to utilize the basic chemistry techniques and determination methods in the given task. Furthermore, the student can also make laboratory notes and write a report on the performed task.

Contents:

Laboratory safety, basic laboratory equipment, basic chemistry techniques and determination methods as well as some of their theoretical background, carrying out chemical synthesis and checking the purity of the product, problems related to the studied determination methods, keeping a laboratory notebook, writing a report.

Mode of delivery:

Supervised laboratory work, independently done preparatory problems.

Learning activities and teaching methods:

Safety in laboratory 2 hours, 65 hours of laboratory work + demonstrations + problems, 67 hours of self-study.

Target group:

Biochemistry, Process Engineering, Environmental engineering, compulsory. In the entity of 25 credits, compulsory. Physical Sciences, Geology, Mathematical Sciences, optional.

Prerequisites and co-requisites:

General and Inorganic Chemistry A (780117P, 5 cr) and Introduction to Organic Chemistry (780116P, 5 cr). Student is allowed to participate to the course simultaneously when participating the prerequisites. Attendance at the lecture of Safety in laboratory is compulsory.

Recommended optional programme components:

Participation in the courses General and Inorganic Chemistry A (780117P, 5 cr) and Introduction to Organic Chemistry (780116P, 5 cr).

Recommended or required reading:

Instruction Book (in Finnish): Kemian perustyöt

Assessment methods and criteria:

Accomplishment of the course requires accepted preparatory problems, laboratory exercises, problems related to them and final examination. Laboratory exercises and final examination has to be completed within next two terms.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes verbal grading scale pass/fail.

Person responsible:

Ph.D. Teija Kangas

Working life cooperation:

No

Other information:

Attendance at the lecture of Safety at work is compulsory. The exercises must be done before each laboratory assignment. Deadline of the written report is binding. Failure will lead to the renewal of the work.

477000P: Planning of Studies and Career, 1 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Saara Luhtaanmäki

Opintokohteen kielet: Finnish

Leikkaavuudet:

030001P	Orientation Course for New Students	1.0 op

ECTS Credits:

1 ECTS /28 hours of work

Language of instruction:

Finnish

Timing:

The course unit is given in the autumn semester, during periods 1 and 2

Learning outcomes:

The aim of the course is to introduce new students to the university, academic studies, the studies of his /her degree programme in the Faculty of Technology

Contents:

Issues related to the beginning of the studies. Goals, structures and contents of the studies in the Faculty of Technology. Preparing a Personal Study Plan. Study techniques and the library.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Tutorials, orientations days organized by the faculty and by the degree programmes, independent studying

Target group:

All first year students in the degree programmes of process engineering and environmental engineering

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Study guide, Teekkarin työkirja

Assessment methods and criteria:

Participation to the tutorials and information sessions and preparing a Personal Study Plan. Student must participate 3 times in the seminars of the course Advanced Practical Training (477005S) and in two topic lectures (Ajankäyttö ja suunnitelmallinen opiskelu, Oppiminen on taitolaji)
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Verbal scale Passed/Failed

Person responsible:

Study councellor Saara Luhtaanmäki

Working life cooperation:

No

Other information:

-

030005P: Information Skills, 1 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Faculty of Technology

Arvostelu: 1 - 5, pass, fail

Opettajat: Sassali, Jani Henrik, Ursula Heinikoski

Opintokohteen kielet: Finnish

Leikkaavuudet:

030004P	Introduction to Information Retrieval	0.0 op

ECTS Credits:

1 ECTS credit

Language of instruction:

Finnish

Timing:

2nd or 3rd year

Learning outcomes:

Students know the different phases of information retrieval process and basic techniques of scientific information retrieval. They will find the most important reference databases of their discipline and know how to evaluate information sources and retrieval results.

Contents:

Retrieval of scientific information, the retrieval process, key databases of the discipline, and evaluation of information retrieval and information sources.

Mode of delivery:

Blended teaching: classroom training, web-based learning material and exercises in Optima environment, a final assignment on a topic of the student's own choice

Learning activities and teaching methods:

Training sessions 8h, group working 7h, self-study 12h

Target group:

Compulsory for all students of the Faculty of Technology, the Faculty of Information Technology and Electrical Engineering and the Faculty of Architecture. In the Faculty of Science compulsory for students of biology, physics, geosciences, chemistry and geography. Optional for students of biochemistry and mathematics.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Web learning material https://wiki.oulu.fi/display/030005P.

Assessment methods and criteria:

Passing the course requires participation in the training sessions and successful completion of the course assignments.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

pass/fail

Person responsible:

Science and Technology Library Tellus, tellustieto (at) oulu.fi

Working life cooperation:

-

Other information:

-

902011P: Technical English 3, 6 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Negotiated Education

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Proficiency level:

CEFR B2 - C1

Status:

This course is compulsory for the students who have chosen English as their foreign language. (See the foreign language requirements for your own degree programme.)

Required proficiency level:

English must have been the A1 or A2 language at school or equivalent English skills acquired otherwise. If you need to take English, but lack this background, please get in touch with the Languages and Communication contact teacher for your department to discuss individual solutions.

ECTS Credits:

6 ECTS credits (The workload is 160 hours.)
STUDENTS OF ENGINEERING: The course consists of 3 x 2-ECTS modules.

STUDENTS OF ARCHITECTURE: The course consists of 2 x 3-ECTS modules.

Students with the matriculation exam grade *Laudatur* or *Eximia cum laude approbatur* will be exempted from part of the course (2 ECTS credits).

Language of instruction:

English

Timing:

STUDENTS OF ENGINEERING:
PYO, KO, TuTa: *1st & 2nd* years of studies, beginning 1st year autumn.
SO & CSE: 2nd & 3rd years of studies, beginning 2nd year autumn.
STUDENTS OF ARCHITECTURE:
1st & 2nd years of studies, beginning 1st year spring and continuing 2nd year autumn.

Learning outcomes:

By the end of the course, you will be able to

- demonstrate efficient strategies and methods for developing and maintaining your English proficiency
- communicate using the core vocabulary required for professional language use in your field
- apply language skills, intercultural awareness and presentation techniques necessary for working in a multicultural environment
- use language, culture and communication skills at a B2-C1 CEFR level in accordance with your own professional needs.

Contents:

In this course, you will focus on developing oral and written English language skills which enable you to follow developments in your own professional field and manage successfully in an international, intercultural working environment.

STUDENTS OF ENGINEERING:
The course consists of three modules:

1. first, **Professional English for Technology** (PET, 2 ECTS credits),
2. then **two modules** (2 ECTS credits each) from a free-choice module menu, in which each module has its own content. These modules allow you to develop further skills in specific core areas. Read the module descriptions with care so that you choose modules which match your own needs, interests and level.

   TuTa students, however, take ONE module from the free-choice menu and then, in second year autumn, the Business Plan module, which is integrated with a course in their own department (*555222A Tuotantotalouden harjoitustyöt*) .

STUDENTS OF ARCHITECTURE:
The course consists of two modules:
See the course description of each module (902011P-38 module A and 902011P-39 module B for a detailed explanation of the course content.

Mode of delivery:

STUDENTS OF ENGINEERING: The mode of delivery varies according to the modules you take. See the course descriptions for the individual modules.
STUDENTS OF ARCHITECTURE: face-to-face teaching in the premises of your own department and independent study

Learning activities and teaching methods:

STUDENTS OF ENGINEERING: The teaching methods and learning activities depend on which free-choice modules you choose. See the course descriptions for the individual modules.
STUDENTS OF ARCHITECTURE:
The classroom teaching comprises about 50% of the total student workload for the course and includes mini-lectures, group and teamwork, student presentations. The independent work component comprises online work and independent study in preparation for classroom activities.

Target group:

Students of the Faculty of Technology
- all Engineering Departments
- the Department of Architecture

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Materials will be provided by the teacher.

Assessment methods and criteria:

Assessment methods vary according to the individual modules taken. The assessment criteria are based on the learning outcomes of the module.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

pass / fail.

Person responsible:

Each department in the Technical Faculty has its own Languages and Communication contact teacher for questions about English studies.

Working life cooperation:

-

Other information:

See the Languages and Communication Study Guide, English, TTK.

901008P: Second Official Language (Swedish), 2 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Negotiated Education

Opintokohteen kielet: Swedish

Leikkaavuudet:

ay901008P	Second Official Language (Swedish) (OPEN UNI)	2.0 op

Proficiency level:

B1/B2/C1 (Common European Framework of Reference)

Status:

This course is compulsory to all students except those who have at least 60 ECTS credits of Swedish studies in their degrees. The language proficiency provided by the course unit is equivalent to the language proficiency required of a state official with an academic degree working in a bilingual municipality area (Act 424/03 and Decree 481/03).
According to the requirements of the law, the student must be able to use Swedish both orally and in writing in various professional situations. Achieving this kind of proficiency during a course unit that lasts for only one semester requires that the student has already achieved the necessary starting proficiency level prior to taking the course.

Required proficiency level:

The required starting proficiency level for students of all faculties is a grade of 7 or higher from the Swedish studies at secondary school (B-syllabus) or equivalent knowledge AND a passing grade from the proficiency test held at the beginning of the course unit. Based on this proficiency test the students are directed to brush up on their language skills if it is deemed necessary; mastering basic vocabulary and grammar is a prerequisite to achieving the necessary language proficiency for the various communication situations one faces in professional life.
If a student has not completed Swedish studies (B-language) at secondary school with a grade of 7 or higher, or his/her language skills are otherwise lacking, he/she must achieve the required proficiency level BEFORE taking this compulsory Swedish course.

ECTS Credits:

2 ECTS credits

Language of instruction:

Swedish

Timing:

Students of the School of Architecture: autumn term of 1st year of studies
Studenst of Students of Industrial Engineering and Management : autumn semester of the 2nd year of studies
Students of Process Engineering and Environmental Engineering: autumn or spring semester of the second year of studies
Mechanical Engineering: autumn or spring semester of the third year of studies
The Faculty of Information Technology and Electrical Engineering: Students of Electrical Engineering and Computer Science Engineering: Autumn or spring term of 1st year of studies.

Learning outcomes:

Upon completion of the course unit the student should be able to read and understand texts from his/her academic field and make conclusions based on them. The student should be able to write typical professional emails and short reports. He/she should be able to carry himself/herself according to Swedish etiquette when acting as host or guest. The student should also be able to discuss current events and special field-specific matters, use the vocabulary of education and plan and give short oral presentations relating to his/her own field.

Contents:

Communicative oral and written exercises, which aim to develop the student's Swedish proficiency in areas relevant to his/her academic field and future professional tasks. The student practises oral presentation and pronunciation. Situational exercises done individually and in pairs and groups. Discussions in small groups. Current texts about the student's special field. Written exercises relating to the student's professional field. Practising presentation skills.

Mode of delivery:

Contact teaching

Learning activities and teaching methods:

1 x 90 minutes of contact teaching per week and self-directed study, 53 hours per course.

Target group:

See Timing

Prerequisites and co-requisites:

See Required Proficiency Level

Recommended optional programme components:

-

Recommended or required reading:

Study material will be provided by the teacher.

Assessment methods and criteria:

The course unit focuses on improving both oral and written language skills and requires active attendance and participation in exercises, which also require preparation time. 100% attendance is required. The course unit tests both oral and written language skills.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Oral and written language proficiencies are tested separately and assessed using the so called KORU-criteria (publication of HAMK University of Applied Sciences, 2006). Separate grades will be awarded for the successful completions of both oral and written portions of the course unit: the possible passing grades are **satisfactory skills and good skills** (see language decree 481/03). The grades are based on continuous assessment and testing.

Person responsible:

See contact teachers on the Language and Communication home page http://www.oulu.fi/languagesandcommunication/student_counselling

Working life cooperation:

-

Other information:

Students sign up for teaching in WebOodi. A student can only sign up for one teaching group. When signing up , it is imperative that the student fills in his/her university email address (paju.oulu.fi), major subject and Swedish grades attained during secondary education in the Further Information field. Information in sign-up periods and course unit timetables can be found in WebOodi.

A432125: Intermediate Studies, Environmental Engineering, 60 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Intermediate Studies

488104A: Industrial and municipal waste management, 5 op

Voimassaolo: 01.08.2005 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisangela Heiderscheidt

Opintokohteen kielet: English

Leikkaavuudet:

480160S	Waste Management of Communities and Industry	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is organized in the autumn semester, during period 1

Learning outcomes:

The student will acquire a wilder view of what is waste and how it is generated and managed in communities and industries. Student will be familiar with waste management hierarchy and how waste legislation regulates waste management. She/he will get basic knowledge about waste treatment methods including their sustainability and related environmental impacts. As well as, how a series of factors influence the planning of waste management activities in industries and municipalities. The student will also be able to understand the energy and material recovery potential within the waste sector.

Contents:

Waste management hierarch, waste prevention principle, municipal waste management, waste management in industries, waste legislation, municipal and industrial waste treatment methods, international treaties related to waste management, waste to energy principle.

Mode of delivery:

Face-to-face teaching and guided assignments.

Learning activities and teaching methods:

Learning methods: A) Active learning method: Lectures (25 h), group work/ exercises (45 h), self-study for examination and completion of exercises (55 h) and field visits (8 h) or alternatively; B) BOOK examination: 100% self-study mode where the student is provided with 2-3 books as reference material and he/she attends an examination.

Target group:

Students in the Bachelor program of Environmental Engineering

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Lecture hand-outs, notes and other materials delivered in lectures; Waste management: a reference handbook illustrated edition, 2008 (electronic book, ISBN 9781598841510); Pippo, S., 2013. Municipal solid waste management in Finland. Greensettle publications. ISBN 978-952-62-0071-2.

Assessment methods and criteria:

A) Active mode: *successful completion of course work which consists of* group exercises 1 and 2 and achieving a pass grade (1-5) in the final exam which is based on lectures material and exercises; B) Self-study mode: achieving a passing grade (1-5) in the exam which is based on provided reference material. Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Researcher Elisangela Heiderscheidt

Working life cooperation:

No

Other information:

-

488201A: Environmental Ecology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488210A	Environmental science and technology	5.0 op
ay488201A	Environmental Ecology (OPEN UNI)	5.0 op
488406A	Introduction to Environmental Science	5.0 op
480001A	Environmental Ecology	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during 4 th period. It is recommended to complete the course at the first (Bachelor's) spring semester.

Learning outcomes:

Upon completion of the course, the student is able to define the basic concepts of environmental ecology. He/she has knowledge about the state of the environment and is able to explain the essential environmental problems and the main effects of pollution. In addition, the student knows some solutions to environmental problems and is aware of ethical thinking in environmental engineering. The student also has basic knowledge about toxicology and epidemiology.

Contents:

Principles of environmental ecology. Roots of environmental problems. Global air pollution: ozone depletion, acid deposition, global warming and climate change. Water pollution, eutrophication, overexploitation of ground and surface water. Main effects of pollution and other stresses. Non-renewable and renewable energy. Energy conservation and efficiency. Hazardous and solid waste problem. Principles of toxicology, epidemiology, and risk assessment. Environmental ethics.

Mode of delivery:

Web-based teaching.

Learning activities and teaching methods:

Book examination 80 h / exercises as individual work 53 h.

Target group:

Bachelor's degree students of environmental engineering.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I and 488011P Introduction to Environmental Engineering recommended beforehand.

Recommended optional programme components:

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Recommended or required reading:

Chiras D.: Environmental Science. New York, Jones and Bartlett Publishers, 9 th edition, 2013.

Assessment methods and criteria:

All students complete the course in a final examination. Also the exercises will be assessed. The assessment of the course is based on the learning outcomes of the course.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Virpi Väisänen

Working life cooperation:

No

Other information:

-

477401A: Thermodynamic Equilibria, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

Leikkaavuudet:

470611A	Metallurgy Processes	7.0 op

ECTS Credits:

5 cr / 135 hours of work

Language of instruction:

Available only in Finnish

Timing:

The course is given in the autumn semester, during period II. It is recommended to complete the course at the 2nd year of Bachelor's studies.

Learning outcomes:

Student is capable of defining chemical equilibria of the systems that are related to industrial processes and understands the relevance of equilibria (and their computational determination) as a part of process analysis, planning and control. Additionally, (s)he can define a meaningful system to be considered in computation thermodynamics; i.e. (s)he can create a computationally solvable problem based on technical problem that in itself is not solvable computationally.

Contents:

Concepts of entalphy (H), entropy (S) and Gibbs free energy (G). The effect of temperature and pressure on H, S and G. Chemical and phase equilibria. Activity and activity coefficient. Calculation of thermodynamic equilibria using equilibrium constant as well as Gibbs free energy minimisation.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Lectures, software exercise as well as other exercises. Available only in Finnish.

Target group:

Students of process and environmental engineering

Prerequisites and co-requisites:

’Basic Principles in Chemistry’ and ’Material and Energy Balances’ as prerequisities

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a education that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Material will be distributed during lectures and exercises.

Assessment methods and criteria:

Students are required to make a portfolio consisting of a learning diary and exercices. Please note that the course is organised only in Finnish.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Eetu-Pekka Heikkinen

Working life cooperation:

No

Other information:

It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun. Course webpage (in Finnish): http://www.oulu.fi/pyomet/477401a.

477201A: Material and Energy Balances, 5 op

Voimassaolo: 01.08.2005 - 31.12.2019

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tiina Leiviskä

Opintokohteen kielet: Finnish

Leikkaavuudet:

477221A	Material and Energy Balances	5.0 op
470220A	Fundamentals of Chemical Process Engineering	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish. The course can be completed in English as a book examination.

Timing:

Autumn period 1

Learning outcomes:

The student is able to formulate material and energy balances for a process by taking into account the restrictions set by reaction stoichiometry. The student knows how the created mathematical formulation can be exploited in process consideration.

Contents:

Formulation of material and energy balances by taking into account the effects of chemical reactions.

Mode of delivery:

Lectures and group exercise

Learning activities and teaching methods:

Lectures 40h, group work 10h and self-study 80h

Target group:

Bachelor students in of Process or Environmental Engineering

Prerequisites and co-requisites:

Basics from the course Introduction to Process Engineering

Recommended optional programme components:

-

Recommended or required reading:

Reklaitis, G.V.: Introduction to Material and Energy Balances. John Wiley & Sons, 1983. ISBN 0-471-04131-9.

Assessment methods and criteria:

During the course, there are two intermediate exams and both of them must be passed. Alternatively student can participate in final exam after the course. In addition to this, the students will be making a group exercise, which will be evaluated.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr Tiina Leiviskä

Working life cooperation:

No

Other information:

-

477222A: Reactor Analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477202A Reactor Analysis 4.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Period 2 (autumn term)

Learning outcomes:

By completing the course the student is able to explain the determination methods of the reaction rate from experimental data and he/she can illustrate the basics of deterministic modelling. On that basis, the student has skills to analyse the behaviour of ideal reactors and to perform initial reactor selection and sizing.

Contents:

Elementary reactions, kinetics of homogenous reactions. Reaction rate on the basis of experimental data. Modelling of ideal reactors. Yield, selectivity and reactor size. Heuristics for selecting reactor type and operating conditions.

Mode of delivery:

Lectures and small group exercises

Learning activities and teaching methods:

Lectures 40h and self-study 90h

Target group:

Bachelor students in process and environmental engineering, minor subject students

Prerequisites and co-requisites:

Objectives of 477201A Material and Energy Balances and 477401A Thermodynamic Equilibrium

Recommended optional programme components:

-

Recommended or required reading:

Lecture handouts. Levenspiel, O., Chemical Reaction Engineering. John Wiley & Sons, New York, 1972 (Chapters 1-8). Atkins, P.W.: Physical Chemistry, Oxford University Press, 2002. 7th Ed. (Parts) ISBN 0-19-879285-9.

Assessment methods and criteria:

Combination of examination and group exercises

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

No

Other information:

-

477052A: Fluid Mechanics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477301A	Momentum Transfer	3.0 op

ECTS Credits:

5 ECTS / 133 hours of work.

Language of instruction:

Finnish, can be completed in English as a book examination.

Timing:

Implementation in spring semester during 3 rd period. It is recommended to complete the course at the second (Bachelolor's) spring semester. The course will be lectured first time in spring 2016.

Learning outcomes:

After the course the student is able to determine the viscosity of pure substances and mixtures and to estimate the effect of temperature and pressure on viscosity. The student is able to recognise the interactions between a solid body and flowing fluid and to distinguish the forces, their directions and to calculate their magnitudes. The student is able to formulate momentum balance equations and to solve these in order to calculate velocity distribution, flow rate and pressure drop. The student is able to distinguish laminar and turbulent flow regimes from others and is able to use the correct equations according to flow regime. After the course the student is able to design pipelines and other simple flow mechanical process equipment.

Contents:

Viscosity. Mechanism of momentum transfer. Creating and solving differential momentum balances. Friction factor. Macroscopic balances. Flow in pipes and open-channels.

Mode of delivery:

Face-to-face teaching in Finnish. Book examination in English.

Learning activities and teaching methods:

Lectures 45 h, homework 15 h and self-study 73 h. For foreign students written examination based on given literature.

Target group:

Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:

Knowledge of solving differential equations.

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Munson, B.R., Young, D.F. & Okiishi, T.H. Fundamentals of Fluid Mechanics.

Assessment methods and criteria:

This course utilizes continuous assessment. During the course there are 5 intermediate exams. The course can also be completed by final examination. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Eero Tuomaala

Working life cooperation:

No

Other information:

-

477322A: Heat and Mass Transfer, 5 op

Voimassaolo: 01.08.2015 - 31.07.2019

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477323A	Mass and Heat Transfer	5.0 op
477302A	Heat Transfer	3.0 op
477303A	Mass Transfer	3.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish, can be completed in English as a book examination

Timing:

Implementation in autumn semester during 1 st period. It is recommended to complete the course at the third (Bachelor's) autumn semester. The course will be lectured first time in autumn 2016.

Learning outcomes:

After passing the course the student knows what happens when heat is transferred by conduction, convection and radiation. The student can describe energy transfer with differential energy balances connected with momentum balances; In macro scale the student is able to solve practical heat transfer problems by correlating heat transfer coefficients to dimensionless flow and material characteristics; With the help of these transfer coefficients the student is capable of estimating the size of heat transfer equipment, especially heat exchangers and select the most suitable and profitable types; and to Sketch large heat nets and to diminish the costs of the equipments.
The student is able to use the pinch method which optimises the number of heat exchangers and total energy consumption. He/she is also able to apply the exergy principle to make work from thermal energy. With the aid of this principle he/she will be able to divide the costs of the used energy in right proportion based on the processing stage. He/she student is able to explain diffusion as a phenomenon and the factors affecting it. He/she is able to model mass transfer in simple systems by using the theory of Fick. The student is capable of modeling diffusion by differential mass balances. He/she recognises the special features of mass transfer in turbulent systems and the role of different transport phenomena in mass transfer equipment. He/she has rudimentary practical skills applicable to the scale-up of the equipment used for absorption.

Contents:

Mechanism of heat transfer. Creating and solving differential energy balances. Heat transfer coefficient. Macroscopic balances. Selection of a proper type of heat exchanger.Scale-up and design of a heat exchanger.Design of heat exchanger networks using pinch technology.Exergy analysis for the heat flows. Diffusion. The Fick law of diffusion. Mass transfer in simple systems. Differential mass balances. Models of mass transfer in turbulent systems. Interphase mass transfer. Absorption.

Mode of delivery:

Face-to-face teaching in Finnish. Book examination possible in English.

Learning activities and teaching methods:

Lectures 45 h, homework 15 h and self-study 73 h. For foreign students written examination based on given literature.

Target group:

Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:

Knowledge of solving differential equations.

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

(Will be announced later)

Assessment methods and criteria:

This course utilizes continuous assessment. During the course there are 5 intermediate exams. The course can also be completed by final examination. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Kaisu Ainassaari

Working life cooperation:

No

Other information:

-

477304A: Separation Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Muurinen, Esa Ilmari, Ainassaari, Kaisu Maritta

Opintokohteen kielet: Finnish

Leikkaavuudet:

470323A	Separation Processes	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work.

Language of instruction:

Finnish, can be completed in English as a book examination.

Timing:

Implementation in autumn semester during 2 nd periods. It is recommended to complete the course on the third (Bachelor's) autumn semester.

Learning outcomes:

After the course the student is able to define the position of separation processes based on mass transfer in process and environmental engineering. He/she is capable of solving phase equilibrium problems in multistage separations for binary mixtures. The student is able to explain the phenomena behind the following separation processes: distillation, absorption, stripping, liquid-liquid extraction, supercritical extraction, crystallisation, adsorption, chromatography separation, membrane separations, and reactive separations. He/she recognises the equipment used for these processes and is able to compare the methods to each other with heuristic rules.

Contents:

Separation processes based on mass transfer in process and environmental engineering. Phase equilibrium problems in multistage separations for binary mixtures. Phenomena behind the following separation processes: distillation, absorption, stripping, liquid-liquid extraction, supercritical extraction, crystallisation, adsorption, chromatography separation, membrane separations, and reactive separations. Equipment used for these processes and is able to compare the methods to each other with heuristic rules, etc.

Mode of delivery:

Face-to-face teaching in Finnish. Book examination possible in English.

Learning activities and teaching methods:

Lectures 40 h, exercises 20 h, homework 15 h and self-study 58 h. For foreign students written examination based on given literature and homework.

Target group:

Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:

Courses 477301A Momentum Transfer, 477302A Heat Transfer and 477303A Mass Transfer or 477052A Fluid Mechanics and 477312A Heat and Mass Transfer are recommended beforehand.

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Seader, J.D., Henley, E.J. & Roper, D.K.: Separation Processes Principles. Wiley 2011, 821 p.; Noble, R. D. & Terry, P.A.: Principles of Chemical Separations with Environmental Applications. Cambridge 2004, Cambridge University Press.321 p.

Assessment methods and criteria:

Homework assignments affect the course grade. Examination. The course can be completed with two intermediate exams or one final exam. Homework assignments affect the course grade. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Laboratory manager Dr Esa Muurinen

Working life cooperation:

No

Other information:

-

477121A: Particle Technology, 5 op

Voimassaolo: 01.08.2015 - 31.07.2022

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477120A	Fluid and Particle Engineering	5.0 op
477101A	Fluid and Particle Engineering I	3.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

Finnish

Timing:

Implementation in spring term, period 4

Learning outcomes:

Upon completion of the course, a student should be able to identify the mainline mechanical processes in process industry enhancing the degree of upgrading, as well as recovery operations related to those mechanical main processes. The student is able to identify the equipments related to the mechanical processes and can explain their purpose of use and their operational principles.

Contents:

Granular material and sampling, particle size and particle size distribution, specific surface area, basics in grinding, crushing, sieving and mineral concentration, froth flotation, mineral concentration methods based on density difference, magnetic concentration and other concentration methods, granulation, separation from suspensions

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

The implementation methods of the course are varying. Lectures and exercises max. 48 h. A part of teaching can be replaced by home or group works.

Target group:

: Bachelor students in process and environmental engineering

Prerequisites and co-requisites:

Introduction to process and environmental engineering I (477011P)

Recommended optional programme components:

-

Recommended or required reading:

Lecture materials and other materials that will be announced at the lectures

Assessment methods and criteria:

This course utilizes continuous assessment including lecture diaries and three intermediate exams. Alternatively, the course can also be completed by taking the end exam.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Ari Ämmälä

Working life cooperation:

No

Other information:

-

477122A: Bulk Solids Handling, 5 op

Voimassaolo: 01.08.2015 - 31.07.2023

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477120A	Fluid and Particle Engineering	5.0 op
477102A	Fluid and Particle Technology II	4.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

Finnish

Timing:

Implementation in period 2 (autumn term)

Learning outcomes:

Upon completion of the course, a student should be able to identify auxiliary mechanical unit processes as well as equipments and phenomena related to them. In addition, the student can explain application of unit processes and can describe their operational principles.

Contents:

Liquid and susensions: fluid mechanics, pumping and hydraulic transport, mixing. Gases and aerodispersions: gas dynamics, compression, pneumatic transport. Granular bulk material: properties, storage, mechanical transportation, fluidization.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

The implementation methods of the course vary. Lectures and exercises max. 48 h. A part of teaching can be replaced by home or group works.

Target group:

Bachelor students in process or environmental engineering

Prerequisites and co-requisites:

477101A Particle Technology

Recommended optional programme components:

-

Recommended or required reading:

Lecture materials and other materials that will be announced at the lectures

Assessment methods and criteria:

This course utilizes continuous assessment including lecture diaries and three intermediate exams. Alternatively, the course can also be completed by taking the end exam.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Ari Ämmälä

Working life cooperation:

No

Other information:

-

488051A: AutoCAD and Matlab in Process and Environmental Engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477033A	Programming in Matlab	2.5 op
477032A	AutoCAD in Process and Environmental Engineering	2.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Periods 3-4 (spring term)

Learning outcomes:

Upon completion of the course, the student will have readiness to use AutoCAD and Matlab programs in different planning and problem solving assignments of process and environmental engineering.

Contents:

Properties of the AutoCAD program, planning exercises (e.g. process flow chart, map planning, instrumentation layout). Basic use, plotting, programming structures, problem solving and finding programming errors with Matlab.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Computer class lectures (24 h), exercises (36 h). Face-to-face teaching 20 h (lectures and group work).

Target group:

Bachelor level students in the Process and Environmental Engineering program

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes

Assessment methods and criteria:

Continuous evaluation of exercises. Home assignments.

Grading:

Pass/fail

Person responsible:

Post-doctoral researchers Pekka Rossi and Aki Sorsa

Working life cooperation:

No

Other information:

-

477051A: Automation Engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477601A	Process Automation Systems	4.0 op

ECTS Credits:

5 ECTS /133 h of work

Language of instruction:

Finnish

Timing:

Autumn, period 1

Learning outcomes:

Students learn how to use PI diagrams, field instruments, automation systems and PLCs in design, implementation and commissioning projects. Students can configure and program the basic automation functions in DCSs and PLCs

Contents:

The operational and structural descriptions and concepts of process automation, automation commissioning projects, PI diagrams and field devices, configuration tools for automation functions, logic programming, telecommunication technology in automation, field buses, examples of commercial DCSs, PLCs and field bus systems

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures, demonstrations, configuration and logic programming exercises, excursion to a neighbouring industrial plant

Target group:

B.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

477011P Introduction to process and environmental engineering I and 448010P Introduction to process and environmental engineering II are recommended

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes and handouts, manuals/handbooks

Assessment methods and criteria:

Learning diary or examination

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Jukka Hiltunen and Aki Sorsa

Working life cooperation:

No

Other information:

-

A432126: Environmental Engineering, Water and Geotechnics, 25 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Module Preparing for the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Water and geotechnics

488012A: Environmental Legislation, 5 op

Voimassaolo: 01.01.2011 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488101A	Environmental Legislation	5.0 op

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

Finnish

Timing:

The course unit is given in the autumn semester, during period 2

Learning outcomes:

Upon completion of the course, the student will be able to explain the main component of Finnish environmental legislation and knows the structure of environmental administration in governmental and municipal level; authorities, jurisdiction and duties. The student will be able to understand differences between EIA and environmental permits. Having completed the course, the student knows what permits and acts must be considered in different cases relating to mining, water and energy initiatives.

Contents:

Environmental Legislation of Finland

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 11 h, seimar 9 h and self-study 115 h. Totally 135 h.

Target group:

Students in bachelor program of environmental engineering

Prerequisites and co-requisites:

None

Recommended optional programme components:

-

Recommended or required reading:

Ympäristöoikeuden pääpiirteet (Ekroos, Kumpula 2010, ISBN: 9789510361283), lecture notes

Assessment methods and criteria:

Group work (50% of the final grade of the course) and seminar (50%). Seminar includes presentation and discussion.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

-

488102A: Hydrological Processes, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay488102A Hydrological Processes (OPEN UNI) 5.0 op

480207A Hydraulics and Hydrology 5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish, course can also be completed in English as a self-study/book exam

Timing:

The course unit is given in the autumn semester during period 1. Also the English version of the course is only available in the autumn semester.

Learning outcomes:

After the course, the student understands and can describe the main hydrological processes, water movements and hydraulics phenomenon quantitatively through mathematical methods. The student also understands and quantifies the relation between state and flow with relation to snowmelt, evaporation, infiltration and groundwater flow. After couse student have knowledge also to design pipe and open channel projects.

Contents:

Hydrological cycle, physical properties of water, distribution of water resources, water balance, precipitation, evapotranspiration, soil and ground water, infiltration, runoff, snow hydrology, hydrometry, water quality of rivers and lakes, open channel flow, flow in pipe systems.

Mode of delivery:

Face-face teaching in Finnish, self-study package in English

Learning activities and teaching methods:

For the English self-study package, 4 tutor sessions are arranged during the autumn semester

Target group:

Students in international programs of environmental engineering

Prerequisites and co-requisites:

No

Recommended optional programme components:

The course is a prerequisite for Master level studies

Recommended or required reading:

Physical Hydrology (Dingman SL, 2002, 2nd Edition, ISBN 978-1-57766-561-8), Fluid Mechanics and Hydraulics (Giles, Evett and Liu, 3rd Edition, ISBN 0-07-020509-4)

Assessment methods and criteria:

Both hydrology and hydraulics assignments must be returned and passed with threshold of 50% in order to get final examination. The final grade of the course is weighted average of assignments (80%) and examination (20%)

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Read more about assessment criteria at the University of Oulu webpage.

Person responsible:

University Lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

-

488119A: Basics of infrastructure planning and development, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

485021A	Construction Contracting	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Period 4 (spring term)

Learning outcomes:

By completing the course the student knows different roles of experts in a construction project (subscriber, authority, designer, contractor, supervisor, construction consultant) and how these projects will be carried out in environmental and civil engineering

Contents:

During the course following issues will be covered: InfraRYL, MaaRYL, planning, contract technical issues, tendering, the value of the built environment to national economy (for example value of infrastructure or Maintenance backlog)

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Face-to-face teaching 40 h and exercises ad self-study

Target group:

Bachelor's students in the Environmental Engineering program

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes

Assessment methods and criteria:

Exam and exercises

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Bjørn Kløve

Working life cooperation:

No

Other information:

-

488115A: Geomechanics, 5 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Kauko Kujala
Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course unit is given in the spring semester, during period 3

Learning outcomes:

Have a clear understanding of mechanical behaviour of soil structures in loading and environmental conditions. Understand design and dimensioning principles and can explain environmental aspects of soil behaviour.

Contents:

Origins and composition of soils, classification of soils, stress and strains in soils, mechanical properties of soils, stability of slopes, bearing capacity of foundation, seepage analyses, freezing and thawing of soils, site investigations and in situ testing.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (40 h) and calculation exercises (20 h) also independent work (75 h)

Target group:

Students in Bachelor program of Environmental Engineering

Prerequisites and co-requisites:

No

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout and other materials delivered in lectures

Assessment methods and criteria:

Examination
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Kujala

Working life cooperation:

No

Other information:

-

477502A: Experiment design and analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Aki Sorsa

Opintokohteen kielet: Finnish

Leikkaavuudet:

470432A	Process Control Engineering II	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Implementation in the 4th period on the spring term

Learning outcomes:

After the course, the student knows different experimental design methods and their applicability for different problems. He can also design experiments for multi-variable processes and analyze the results. He can also use some basic means to visualize the results got from experimental data and choose proper tools for experiment design problems.

Contents:

Systematic design of process experiments with matrix techniques (Hadamard, Central Composite Design, Taguchi). Graphical and statistical analysis of experimental data. Correlation, regression and variance analysis. Dynamic data based modelling.

Mode of delivery:

Lectures and extensive exercise work

Learning activities and teaching methods:

Lectures during one period

Target group:

Bachelor’s students in process and environmental engineering

Prerequisites and co-requisites:

Course Process Dynamics is recommended beforehand

Recommended optional programme components:

The course forms a basis to the advanced courses in the field of control engineering

Recommended or required reading:

Reading materials. *Additional literature*: Diamond W.J.: Practical Experiment Designs. Lifetime Learning Publications. Belmont, California, 1981. 348 pp.

Assessment methods and criteria:

Examination. It is recommended to take the course also according to the principle of continuous evaluation.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Read more about assessment criteria at the University of Oulu webpage.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

For exchange/international students also the course 477041S Experimental Design is recommended

A432127: Environmental Engineering, 25 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Module Preparing for the Option
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Environmental Engineering

488012A: Environmental Legislation, 5 op

Voimassaolo: 01.01.2011 - 31.07.2017
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English
Leikkaavuudet:

488101A	Environmental Legislation	5.0 op

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

Finnish

Timing:

The course unit is given in the autumn semester, during period 2

Learning outcomes:

Upon completion of the course, the student will be able to explain the main component of Finnish environmental legislation and knows the structure of environmental administration in governmental and municipal level; authorities, jurisdiction and duties. The student will be able to understand differences between EIA and environmental permits. Having completed the course, the student knows what permits and acts must be considered in different cases relating to mining, water and energy initiatives.

Contents:

Environmental Legislation of Finland

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 11 h, seimar 9 h and self-study 115 h. Totally 135 h.

Target group:

Students in bachelor program of environmental engineering

Prerequisites and co-requisites:

None

Recommended optional programme components:

-

Recommended or required reading:

Ympäristöoikeuden pääpiirteet (Ekroos, Kumpula 2010, ISBN: 9789510361283), lecture notes

Assessment methods and criteria:

Group work (50% of the final grade of the course) and seminar (50%). Seminar includes presentation and discussion.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

-

488309A: Biocatalysis, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

488212A	Fundamentals of catalysis	5.0 op
488308A	Enzyme Technology	2.0 op
488301A	Microbiology	3.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course is given in autumn semester during period 1. It is recommended to complete the course in the 3rd year.

Learning outcomes:

After completing this course, the student will be able to define what biocatalysts are. Student is able to describe in which way different microbes and enzymes can be applied as biocatalysts and can give examples how biocatalysts are applied. The student will be able to evaluate the cultivation and growth of microbes and the use of them in the production of different products. The student recognizes the effect of the structure and the reaction conditions to the function of enzymes, and can explain the basic principles of enzymatic reactions and enzyme kinetics. Student will be able to judge how microbes and enzymes could be applied in industry.

Contents:

Microbes and enzymes as biocatalysts and the use of them in industry. The structural and functional characteristics, metabolism, products from metabolism, physiology, and growth of prokaryotic and eukaryotic cells from industrial point of view. The structure and function of enzymes, enzymatic reactions and kinetics.

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

Lectures 50 h / home work and web-based learning 10 h / self-study 73 h

Target group:

Bachelor students in process engineering and environmental engineering

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout; Madigan MT, Martinko JM & Parker J: Brock Biology of Micro-organisms. Prentice Hall, 13. and newer edition. 978-0-321-73551-5; Illanes A (ed.): Enzyme Biocatalysis - Principles and Applications. Springer. 978-90-481-7854-4; Aittomäki E et al.: Bioprosessitekniikka. WSOY 2002. 951-26995-6; other material announced in the lectures.

Assessment methods and criteria:

Lectures, intermediate exams (välikokeet) or final examination and home work. Grade will be composed of home work and intermediate exams (välikokeet) or final examination.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Johanna Panula-Perälä

Working life cooperation:

No

Other information:

-

488052A: Introduction to Bioproduct and Bioprocess engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488054A	Introduction to Bioproduct and Bioprocess engineering	5.0 op
488302A	Basics of Biotechnology	5.0 op
477103A	Pulp and Paper Technology	3.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course is held in spring semester during period 3. It is recommended to complete the course in the 3 rd (Bachelor's) year

Learning outcomes:

After completing this course, a student should be able to identify key renewable natural resources and their sustainable and economical processing via mechanical, chemical and biotechnological methods. The student is able to recognize the major properties of the bioproducts and their use in different applications.

Contents:

Renewable raw materials and their properties, value chains of biomass processing, recycling of biomaterials, bioenergy, and economical and environmental aspects. Industrial biotechnology for food and pharmaceutical applications, materials industries and environmental applications.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures 48 h/ self-study 85 h.

Target group:

Bachelor students in process engineering and environmental engineering.

Prerequisites and co-requisites:

488309A Biocatalysis or respective knowledge in biocatalysis.

Recommended optional programme components:

-

Recommended or required reading:

Lecture materials and other materials that will be announced at the lectures. Supplementary material: Book series: Fapet Oy. Papermaking Science and Technology; Aittomäki E et al.: Bioprosessitekniikka. WSOY 2002. 951-26995-6.

Assessment methods and criteria:

Lectures, intermediate exams and/or final exam. Grade will be composed of lecture exams and/or final exam. Read more about the course assessment and grading systems of the University of Oulu at www. oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Johanna Panula-Perälä, Adjunct professor Ari Ämmälä

Working life cooperation:

No

Other information:

-

477502A: Experiment design and analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Aki Sorsa

Opintokohteen kielet: Finnish

Leikkaavuudet:

470432A	Process Control Engineering II	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Implementation in the 4th period on the spring term

Learning outcomes:

After the course, the student knows different experimental design methods and their applicability for different problems. He can also design experiments for multi-variable processes and analyze the results. He can also use some basic means to visualize the results got from experimental data and choose proper tools for experiment design problems.

Contents:

Systematic design of process experiments with matrix techniques (Hadamard, Central Composite Design, Taguchi). Graphical and statistical analysis of experimental data. Correlation, regression and variance analysis. Dynamic data based modelling.

Mode of delivery:

Lectures and extensive exercise work

Learning activities and teaching methods:

Lectures during one period

Target group:

Bachelor's students in process and environmental engineering

Prerequisites and co-requisites:

Course Process Dynamics is recommended beforehand

Recommended optional programme components:

The course forms a basis to the advanced courses in the field of control engineering

Recommended or required reading:

Reading materials. *Additional literature*: Diamond W.J.: Practical Experiment Designs. Lifetime Learning Publications. Belmont, California, 1981. 348 pp.

Assessment methods and criteria:

Examination. It is recommended to take the course also according to the principle of continuous evaluation.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Read more about assessment criteria at the University of Oulu webpage.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

For exchange/international students also the course 477041S Experimental Design is recommended

477203A: Process Design, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jani Kangas

Opintokohteen kielet: English

Leikkaavuudet:

480310A	Fundamentals of Process Design	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring period 4

Learning outcomes:

By completing the course the student is able to identify the activities of process design and the know-how needed at different design stages. The student can utilise process synthesis and analysis tools for creating a preliminary process concept and point out the techno-economical performance based on holistic criteria.

Contents:

Acting in process design projects, safety and environmentally conscious process design. Design tasks from conceptual design to plant design, especially the methodology for basic and plant design.

Mode of delivery:

Lectures and design exercises.

Learning activities and teaching methods:

Lectures 30h, group work 50h and self-study 50h

Target group:

Bachelor students

Prerequisites and co-requisites:

Objectives of 477202A Reactor analysis and 477304A Separation processes

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout, Seider, W.D., Seider, J.D. and Lewin, D.R. Product and process design principles: Synthesis, analysis and evaluation. John Wiley & Sons, 2004. (Parts) ISBN 0-471-21663-1

Assessment methods and criteria:

Combination of examination and design exercises.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

Scale 0-5

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

-

Other information:

-

A432124: Working Life Studies, Environmental Engineering, 25 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic and Intermediate Studies

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Working Life Studies

555225P: Basics of industrial engineering and management, 5 op

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Jukka Majava

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay555225P Basics of industrial engineering and management (OPEN UNI) 5.0 op

555221P Introduction to Production 2.0 op

555220P Basic Course in Industrial Engineering and Management 3.0 op

Language of instruction:

Finnish. English material is also used.

Timing:

Periods 1-2.

Learning outcomes:

Upon completion of the course the student should be able to describe what operations management means. The student can explain the core concepts of business operations and utilize these concepts in describing and analyzing organizational operations. In addition, he/she can explain in general terms the factors that affect economic performance of organizations. The student is able to utilize the terminology used in operations management, describe the financial processes of companies and based on this describe the use of cost accounting in organizational decision-making. The student can also calculate unit costs in various simplified settings, calculate various alternatives, as well as perform planning and goal oriented calculations based on given data, and draw conclusions based on the calculation results.

Contents:

Operations and productivity, operations strategy, forecasting, cost accounting, investments, sustainability, capacity management, location decisions, layout strategies, human resources management, supply chain management, subcontracting, inventory management, production planning, MRP & ERP, production scheduling, Just-in-Time & Lean operations, maintenance.

Mode of delivery:

The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:

Web-based lectures 20 h / exercises 18 h / self-study 96 h.

Target group:

: Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:

No prerequisites exist.

Recommended optional programme components:

This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555285A Project management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

Recommended or required reading:

Lecture and exercise materials. Heizer, J. & Render, B. (2014) Operations management: sustainability and supply chain management, 11th ed. Pearson.

Assessment methods and criteria:

This course utilizes continuous assessment. During the course, there are nine mandatory weekly assignments. At least half of the assignments must be passed.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

D.Sc. Jukka Majava.

Working life cooperation:

No.

Other information:

Substitutes courses 555220P Basic Course in Industrial Engineering and Management 3 ECTS cr and 555221P Introduction to Production 2 ECTS cr.

555265P: Occupational Safety and Health Management, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Henri Jounila
Opintokohteen kielet: Finnish
Leikkaavuudet:

555263A	Technology, Society and Work	2.0 op
555260P	Basic Course in Occupational Safety and Wellbeing at Work	3.0 op

Required proficiency level:

ECTS Credits:

5,0 ECTS credits.

Language of instruction:

Finnish. English material is also used.

Timing:

Periods 3-4.

Learning outcomes:

After the course the student is capable of explaining basic terms of occupational safety and health. He/she is able to assess the importance of occupational safety, health and well-being at work. In addition, he/she is able to assess the significance of occupational safety in the improving of productivity and quality. He/she can apply different safety analysis. Upon completion of the course the student is familiar with the core issues of occupational safety and health management.

Contents:

Occupational safety and health, safety management, safety culture, laws and standards, hazards and risks, occupational diseases and work accidents, safety analysis, occupational safety at shared industrial work sites, occupational safety card, HSEQ-assessment procedure, other current issues.

Mode of delivery:

The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:

Lectures and assignments 26 h / group work 40 h / self-study 68 h.

Target group:

Industrial Engineering and Management, Mechanical Engineering, Process Engineering and Environmental Engineering students.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Lecture materials. Other materials will be defined during the course.

Assessment methods and criteria:

The grading is based on the exam (50 % of the grade) and exercises (50 % of the grade).

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Henri Jounila

Working life cooperation:

No.

Other information:

Substitutes courses 555260P Basic Course in Occupational Safety and Wellbeing at Work + 555263A Technology, Society and Work.

477004A: Practical Training, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Saara Luhtaanmäki

Opintokohteen kielet: Finnish

Leikkaavuudet:

488001A	Practical Training	3.0 op
477001A	Practical Training	3.0 op

ECTS Credits:

5 ECTS, 2 months working full-time

Language of instruction:

Finnish or English

Timing:

Student usually works during the summer time

Learning outcomes:

During the practical training students will acquaint themselves with working environments, preferably within their own study field, from the point of view of their studies and within one possible future job. They can identify problems associated with their working environment and can propose improvements to those. The students will experience what are the common features of working life and studies.

Contents:

-

Mode of delivery:

Working as an employee

Learning activities and teaching methods:

Students will find the training positions themselves. Suitable areas for practical training are, for example, the chemical industry, the pulp and paper industry, the metallurgical and mining industry, the biotechnological and food industry, and partly the electronics and automation industry.

Target group:

Bachelor’s students in Process and Environmental Engineering

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

-

Assessment methods and criteria:

Student has to present their original references and submit an application form and a training report to their tutor teacher. The reference must include the training period (from - to) and the duties.

Grading:

Verbal scale Passed/Failed

Person responsible:

Student councellor Saara Luhtaanmäki

Working life cooperation:

Yes

Other information:

The objective is to give an overview of the industrial area where the student may possibly work after graduation. Practical training nurtures theoretical study. In addition the training should give the student a general idea about the company and its technical and organizational operations, financial management and supervision. Student training positions often place students in employee-type positions so that the student becomes familiar with practical work, work safety, as well as with the social nature of the working environment. Students will land the jobs themselves.

900060A: Technical Communication, 2 op

Voimassaolo: 01.08.2005 - 31.07.2021

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Negotiated Education

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900060A	Technical Communication (OPEN UNI)	2.0 op
470218P	Written and Oral Communication	3.0 op

Proficiency level:

-

Status:

This course unit is compulsory for students of Electrical Engineering, Computer Science, Communications Technologies and Engineering Mechanical Engineering, Process and Environmental Engineering.

Required proficiency level:

-

ECTS Credits:

2 credits

Language of instruction:

Finnish

Timing:

Electrical Engineering, Computer Science and Engineering and Communications Technologies: 2nd year spring term or 3rd year autumn term or 3rd year spring term.
Mechanical Engineering: 3rd year.
Process and Environmental Engineering: 1 st year spring or autumn term.

Learning outcomes:

Upon completion of the course the student should be familiar with the central principles of work and study-related communication, both oral and written, and be able to apply this knowledge in his/her own communication. The student should be able to prepare and give an illustrative and understandable oral presentation on a topic related to his/her own field in a way that suits the audience and the situation. The student should also be able to seek information and report on his/her findings in writing. The student should be able to analyse and assess his/her own writing and the writing of his/her peers. He/she should be able to act in group communication situations in a target-oriented manner. The student should also be able to give and receive constructive criticism.

Contents:

Professional communication skills: team writing, the process of writing and its different stages, distinctive features of formal scientific and professional texts, oral communication, preparing an illustrative presentation, methods of convincing one's audience, giving and receiving constructive criticism, the features of a functioning team, the group process and the roles of team members, negotiations and meeting practices.

Mode of delivery:

Multimodal teaching

Learning activities and teaching methods:

Contact hours ca. 20 h and independent group work or self-study ca. 40 h.

Target group:

Bachelors students of Electrical Engineering, Computer Science, Communications Technologies and Engineering Mechanical Engineering, Process and Environmental Engineering.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Kauppinen, Anneli & Nummi, Jyrki & Savola, Tea: Tekniikan viestintä: kirjoittamisen ja puhumisen käsikirja (EDITA); Nykänen, Olli: Toimivaa tekstiä: Opas tekniikasta kirjoittaville (TEK) and material in Optima study environment.

Assessment methods and criteria:

Active participation in contact teaching, independent study and completion of given assignments.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Pass / fail

Person responsible:

Kaija Oikarainen
Toropainen, Outi

Working life cooperation:

-

Other information:

All students are required to attend the first meeting of the course unit so the work groups can be formed and work started in a timely and efficient manner. When signing up for the course unit, you should keep in mind that completing it requires a responsible attitude and a strong commitment to the work because the teamwork-based exercises rely heavily on the participation and activity of the students.
If the student is involved in the University's student associations or functions in a position of trust in university government, student union administration or Oulun Teekkariyhdistys ry (or in its subordinate guilds), he/she may be relieved of some of the group communication exercises. These compensatory actions must always be agreed upon separately with the course unit's teacher. The student must present an official statement from a person in charge of the governing body or association, which details the student's tasks and involvement with that body or association. Participation that took place over five years ago does not entitle the student to any compensation.

488990A: Bachelor's Thesis / Enviromental Engineering, 8 op

Voimassaolo: 01.08.2007 -

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Saara Luhtaanmäki
Opintokohteen kielet: Finnish
Leikkaavuudet:

477990A	Bachelor's Thesis / Process Engineering	8.0 op

Ei opintojaksokuvauksia.

A432225: Module of Option / Basic Module of Clean production, 28 - 31 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

030008P: Information Skills for foreign degree students, 1 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Faculty of Technology
Arvostelu: 1 - 5, pass, fail
Opettajat: Sassali, Jani Henrik, Ursula Heinikoski
Opintokohteen kielet: English

Ei opintojaksokuvauksia.

900017Y: Survival Finnish Course, 2 op

Voimassaolo: 01.08.1995 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuyksikkö: Negotiated Education
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay900017Y	Survival Finnish Course (OPEN UNI)	2.0 op

Proficiency level:
A1.1
Status:
The course is intended for the international students in every faculty of Oulu University.
Required proficiency level:
No previous Finnish studies.

ECTS Credits:

2 ECTS credits

Language of instruction:

Finnish and English

Timing:

-

Learning outcomes:

By the end of the course the student can understand and use some very common everyday expressions and phrases, and s/he can locate informational content in simple texts and messages. The student also knows the basic characteristics of Finnish language and Finnish communication styles.

Contents:

This is an introductory course which aims to help students to cope with the most common everyday situations in Finnish. During the course, students learn some useful everyday phrases, some general features of the vocabulary and grammar, and the main principles of pronunciation.

The topics and communicative situations covered in the course are: general information about the Finnish language, some politeness phrases (how to greet people, thank and apologize), introducing oneself, giving and asking for basic personal information, numbers, some time expressions (how to tell and ask the time, days of the week, time of day), food, drink and asking about prices.

The structures studied are: personal pronouns and their possessive forms, forming affirmative, negative and interrogative sentences, the conjugation of some verbs, the basics of the partitive singular and some local cases for answering the ‘where'-question.

Mode of delivery:

Multi-modal teaching (Contact teaching, on-line teaching and independent work)

Learning activities and teaching methods:

Lessons 1–2 times a week (12–14 h) and guided self study (36 h)

Target group:

International degree and post-graduate degree students and exchange students of the University

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Will be provided during the course.

Assessment methods and criteria:

Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Grading scale is 1-5.

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

Sign-up in WebOodi.

900013Y: Beginners' Finnish Course 1, 3 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Negotiated Education

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900013Y	Beginners' Finnish Course 1 (OPEN UNI)	2.0 op

Proficiency level:

A1.2

Status:

The course is intended for the international students in every faculty of Oulu University.

Required proficiency level:

A1.1, Completion of the Survival Finnish course (900017Y) or the equivalent language skills.

ECTS Credits:

3 ECTS credits

Language of instruction:

As much Finnish as possible; English will be used as a help language.

Timing:

-

Learning outcomes:

By the end of the course the student can understand and use some familiar and common everyday expressions relating to her/himself and everyday situations. S/he can interact in a simple way provided the other person talks slowly and clearly and is willing to help. The student is able to read short simple texts and messages dealing with familiar topics. S/he also deepens her/his understanding of the Finnish language and communication styles.

Contents:

This is lower elementary course which aims to help students to learn communication skills in ordinary everyday situations. During the course, students broaden their vocabulary and knowledge of grammar and principles of pronunciation. They also practise to understand easy Finnish talk about everyday subjects, and reading and writing short and simple texts/messages.

The topics and communicative situations covered in the course are: talking about oneself, one's family, studies and daily routines, as well as asking about these things from other person, expressing opinions, describing people and things, talking about weather and seasons, the names of the months and colours.

The structures studied are: verb types, basics of the change of the consonants k, p and t in verbs and nouns, the genitive and partitive cases, possessive structure, some declension types for nouns (word types) and the basics of the local cases.

Mode of delivery:

Contact teaching and guided self study

Learning activities and teaching methods:

Lessons 2 times a week (26 h) and guided self study (50 h)

Target group:

International degree and post-graduate degree students and exchange students of the University

Prerequisites and co-requisites:

Completion of the Survival Finnish Course

Recommended optional programme components:

-

Recommended or required reading:

Gehring, S. & Heinzmann, S. Suomen mestari 1 (chapters 3 - 5)

Assessment methods and criteria:

Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Grading scale is 1-5.

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

Sign-up in WebOodi. The course will start right after the Survival Finnish course.

488400A: Orientation to the BEE studies, 0 - 1 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kirsi *Marita Puikkonen

Opintokohteen kielet: English

ECTS Credits:

0 cr

Language of instruction:

English

Timing:

Implementation in the autumn semester during the 1 st and 2 nd periods.

Learning outcomes:

After completion of the different parts of this orientation, the student is able to recognize his/her own study environment in the University of Oulu and the study fields of Process Engineering and Environmental Engineering. He/she can make use of the student services of the university. He/she will be able to draft a personal study plan and schedule together with the programme Study Advisor. The student is also able to use the facilities of academic libraries and other student services at the university. He/she will be able to access the tools needed for the studies and in every-day-life.

Contents:

Orientation Days for the New International Students event; Introduction to studies, overview of the services offered by the university, and the student organizations (e.g. academic sports services, student health services); Introduction to the university, faculty and study fields in relation to the BEE studies; Introduction to the methods of studying and to the skills in gaining the tools needed for planning of the studies; Overview of library, Optima, etc. services. Other issues based on the needs of the individual students. Compulsory parts: 1. the Orientation Days for all new international students organized by the University of Oulu, containing an one day by the study programme. 2. Orientation to the BEE master's degree programme. 3. Participation to student tutoring during the autumn term. 4. Planning of PSP (personal study plan) and study schedule, and ratification of the BEE study option Clean Production or Water and Environment.

Mode of delivery:

Implemented mainly as face-to-face teaching, or by distance learning.

Learning activities and teaching methods:

Lectures, visits, seminars, exercises, etc.

Target group:

The new students of the Master's Degree Programme (BCBU) in Environmental Engineering (BEE) only.

Prerequisites and co-requisites:

For BEE students, admission to the Master's programme, for which minimally a former bachelor's degree is required.

Recommended optional programme components:

-

Recommended or required reading:

All materials will be delivered on need-basis (e.g. BEE-study guide book, etc.)

Assessment methods and criteria:

Active participation to all of the different parts of the course; planning the first version of the PSP and the schedule for the 1 st study year together with the Study Advisor (compulsory).
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

Verbal scale Passed/Failed

Person responsible:

BEE Study Advisor Marita Puikkonen (Faculty of Technology, University of Oulu)

Working life cooperation:

No

Other information:

This course is compulsory, even if no credits can be attained by it.

477005S: Advanced Practical Training, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Practical training

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

485002S	Advanced Practical Training	5.0 op
488002S	Advanced Practical Training	3.0 op
477002S	Advanced Practical Training	3.0 op

ECTS Credits:

5 ECTS**,** 2 months working full-time

Language of instruction:

Finnish or English

Timing:

Student usually works during the summer time

Contents:

During the practical training the student will acquaint themselves with the working environment from the point of view of his/her studies and with another possible future job, or with a different assignment already in a familiar working environment. He/she can identify the problems of the working environment and can solve them. The student can apply his/her theoretical knowledge in practical tasks. He/she identifies the tasks appropriate for the Master of Science in Technology at his/her workplace.

Mode of delivery:

Working as employee

Learning activities and teaching methods:

Students will find the training positions themselves. Suitable areas for practical training are, for example, regional environment centers, environmental engineering and consulting offices, water-works, biotechnological and food industry, chemical industry, pulp and paper industry, metallurgical and mining industry, partly electronics and automation industry, and other areas in the private and public sectors.

Target group:

Master's students in Process and Environmental Engineering

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

-

Assessment methods and criteria:

Practical training, seminar presentation reporting their summer job. Student has to present his/her original references and submit an application form to the supervisor of the seminar. The reference must include the training period (from - to) and the duties.

Grading:

Verbal scale Passed/Failed

Person responsible:

Student councellor Saara Luhtaanmäki

Working life cooperation:

Yes

Other information:

The objective is to get a deeper and more detailed conception of the industrial area where the student will possibly work after graduation. Suitable tasks would be supervision tasks and R&D tasks.

488401A: Introduction to the Barents Region, 2 op

Voimassaolo: 01.01.2009 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kirsi *Marita Puikkonen

Opintokohteen kielet: English

ECTS Credits:

2 ECTS credits / 54 hours of work

Language of instruction:

English

Timing:

Implementation in the autumn semester during the 1 st period

Learning outcomes:

After the completion of this course, the student will be able to tell where and what the Barents Region is, describe the main environmental, historical, cultural and socio-economic and health issues related to it including also the special technological and infrastructural factors therein, and evaluate those against the respective issues in his/her country of origin.

Contents:

The Barents environment; History of the Barents collaboration and the political and economic profile of the Barents Region; Infrastructure and building in the Barents Region; People, cultures and livelihoods in the Barents Region; People and health at the Barents Region; Technological challenges and possibilities in the Barents Region.

Mode of delivery:

Implemented as face-to-face teaching, and by distance learning.

Learning activities and teaching methods:

Theme lectures by visiting lecturers, discussions, visits, learning diaries, and a final portfolio.

Target group:

Especially, but not strictly restricted, to the new students of the Master's Degree Programme (BCBU) in Environmental Engineering (BEE).

Prerequisites and co-requisites:

For BEE students, admission to the Master's programme, for which minimally a former bachelor's degree is required. For other students the Bachelor level studies in process or environmental engineering or respective knowledge.

Recommended optional programme components:

-

Recommended or required reading:

Lecture materials are provided during the course and in Optima.

Assessment methods and criteria:

Active participation to the lectures and visits, writing learning diaries therein and a final portfolio.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

BEE Study Advisor Marita Puikkonen (Faculty of Technology, University of Oulu)

Working life cooperation:

No

Other information:

-

488402A: Sustainable Development, 3 op

Voimassaolo: 01.01.2009 - 31.07.2015

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488402S	Sustainable Development	5.0 op

Recommended optional programme components:

Other information:

This course's description can be found by the code 488402S

477307S: Research Methodology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

480311S Research Methodology 3.5 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn and spring semesters during periods 1-4.

Learning outcomes:

After the course the student is able to define the role of research and different stages of research work. The student is also able to classify the stages and the subtasks of research work as well as important elements related to research, i.e. literature search, experimental work, and data processing. In addition, the student can evaluate the amount of work needed in research stages. The student can write scientific text and use references appropriately. The student also has the ability to recognise ethical issues related to research and analyse the meanings of those. He/she can use the principles of good scientific practises and is able to apply knowledge to research work.

Contents:

1) Science and research politics. 2) Research education. 3) Fundamentals of philosophy of science. 4) Starting research work: research types, funding, the process of research work, finding the research area, choosing the research topic, information sources. 5) Research plan and collecting data, experimental methods and significance of the variables, systematic experimental design, collecting experimental data, test equipment, reliability of the results, problems in laboratory experiments, modelling and simulation. 6) Mathematical analysis of results. 7) Reporting: writing a scientific text, referring, writing diploma, licentiate and doctoral theses, or reports. 8) Other issues connected to research work: ethical issues, integrity, and future. 9) Examples of scientific research in practice.

Mode of delivery:

Miniproject based on lectures in Optima during autumn term, contact lectures, laboratory training period during spring term.

Learning activities and teaching methods:

Contact lectures 6 h, miniproject 15 h, training period 70 h, self-study 42 h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

None

Recommended optional programme components:

-

Recommended or required reading:

Melville, S & Goddard, W: Research Methodology; An Introduction for Science and Engineering Students. Kenwyn 1996, Juta & Co. Ltd. 167 p. Hirsijärvi, S., Remes, P. & Sajavaara, P.: Tutki ja kirjoita. Jyväskylä 2004, GummerusKirjapaino Oy. 436 p. Material introduced in the lectures.
Additional literature : Paradis, J.G. & Zimmermann, M.L.: The MIT Guide to Science and Engineering Communication, 2nd ed. Cambridge 2002, The MITPress, 324 p. Nykänen, O.: Toimivaa tekstiä, Opas tekniikasta kirjoittaville. Helsinki 2002, Tekniikan Akateemisten Liitto TEK. 212 p.

Assessment methods and criteria:

Optima exercises (miniproject) and laboratory training.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Mika Huuhtanen

Working life cooperation:

No

Other information:

The objective of the course is to familiarise the student with scientific research, scientific methods and data handling, especially in process and environmental engineering. The course will give the student the basis to do the research work and motivates him/her to begin post-graduate studies. The course gives the student team working skills and increases the co-operation between the students and the research and teaching staff. The students are exposed to experiences in co-operation between different fields of science, industry, and other universities and laboratories, as well as the skills for doctoral studies.

477041S: Experimental Design, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Implementation in the 3rd period (spring term)

Learning outcomes:

After this course the student knows the main methods and software tools for experiment design and is able to use them. He can apply the main approaches for studying and evaluating the measurement reliability.

Contents:

Determining the uncertainty of measurements in chemical, physical and biochemical measurements, measurements reliability and traceability; Calculation examples support the learning of the assessment preparation for measurements uncertainty; Experimental design preparation and execution in process analysis and optimization. Test methods and variable significance, reliability of experimental data; Practical experiment design exercise using a simulation model and Modde software.

Mode of delivery:

Lectures and practical work

Learning activities and teaching methods:

Contact lectures

Target group:

Master's students in the study programmes of Process or Environmental Engineering; exchange students; doctoral students

Prerequisites and co-requisites:

No prerequisites

Recommended optional programme components:

-

Recommended or required reading:

Reading materials given during the lectures

Assessment methods and criteria:

Assessment during the course by continuous evaluation: lecture exams and the written report of the practical work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

-

477203A: Process Design, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jani Kangas

Opintokohteen kielet: English

Leikkaavuudet:

480310A	Fundamentals of Process Design	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring period 4

Learning outcomes:

By completing the course the student is able to identify the activities of process design and the know-how needed at different design stages. The student can utilise process synthesis and analysis tools for creating a preliminary process concept and point out the techno-economical performance based on holistic criteria.

Contents:

Acting in process design projects, safety and environmentally conscious process design. Design tasks from conceptual design to plant design, especially the methodology for basic and plant design.

Mode of delivery:

Lectures and design exercises.

Learning activities and teaching methods:

Lectures 30h, group work 50h and self-study 50h

Target group:

Bachelor students

Prerequisites and co-requisites:

Objectives of 477202A Reactor analysis and 477304A Separation processes

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout, Seider, W.D., Seider, J.D. and Lewin, D.R. Product and process design principles: Synthesis, analysis and evaluation. John Wiley & Sons, 2004. (Parts) ISBN 0-471-21663-1

Assessment methods and criteria:

Combination of examination and design exercises.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

Scale 0-5

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

-

Other information:

-

A432275: Advanced Module/Clean Production, 30 - 62 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

488203S: Industrial Ecology, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Väisänen, Virpi Maria
Opintokohteen kielet: English
Leikkaavuudet:

ay488203S	Industrial Ecology and Recycling	5.0 op
480370S	Industrial Ecology and Recycling	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 th period.

Learning outcomes:

Upon completion of the course, the student will be able to use the tools of industrial ecology and apply them to industrial activity. The student can also analyze the interaction of industrial, natural and socio-economic systems and able to judiciously suggest changes to industrial practice in order to prevent negative impacts. The student can also analyze the examples of industrial symbioses and eco-industrial parks and able to specify the criteria of success for building eco-industrial parks.

Contents:

Material and energy flows in economic systems and their environmental impacts. Physical, biological and societal framework of industrial ecology. Industrial metabolism, corporate industrial ecology, eco-efficiency, dematerialization. Tools of industrial ecology, such as life-cycle assessment, design for the environment, green chemistry and engineering. Systems-level industrial ecology, industrial symbioses, eco-industrial parks.

Mode of delivery:

Face-to-face teaching in English.

Learning activities and teaching methods:

Lectures 30 h / Group work 20 h / Self-study 83 h. The exercises are completred as group work

Target group:

Master's degree students of process and environmental engineering.

Prerequisites and co-requisites:

-

Recommended optional programme components:

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Recommended or required reading:

Lecture notes; Graedel T.E & Allenby B.R.: Industrial Ecology. New Jersey: Prentice Hall, 2003.

Assessment methods and criteria:

All students complete the course in a final exam. Also the exercise will be assessed. The assessment criteria are based on the learning outcomes of the course.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Virpi Väisänen

Working life cooperation:

No

Other information:

-

488202S: Production and Use of Energy, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

488208A	Basics of production and use of energy	5.0 op
470057S	The Energy Economy of Industrial Establishments	3.5 op

ECTS Credits:

5 ECTS credits / 133 hours of work.

Language of instruction:

English

Timing:

Implementation in autumn semester during 1 st period. It is recommended to complete the course at fourth (1 st Master's) autumn semester.

Learning outcomes:

The student is able to define different methods and techniques to generate electricity and heat. He/she is able to explain steam power plant operating principles and is able to compare operation of different kinds of steam power plants. The student can describe the environmental impacts of energy production and is able to compare the environmental impacts of different ways of producing energy. The student is able to identify functioning of the fossil based and renewable energy production systems. He/she is able to explain how the electricity markets work. The student is also able to explain the adequacy of energy reserves.

Contents:

Structure of energy production and consumption. Systems for electric transportation, storing and distribution. Distribution and adequacy of energy resources. Effects of environment contracts on the use of energy resources. Environmental comparison of different energy production methods and fuels. Energy markets. Development views of energy technology.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40h, self-study 93 h.

Target group:

Master's degree students of Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P and 488010P Introduction to Process and Environmental Engineering I and II are recommended.

Recommended optional programme components:

-

Recommended or required reading:

Materials delivered via the Optima environment.

Assessment methods and criteria:

Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Mika Huuhtanen

Working life cooperation:

No

Other information:

-

477309S: Process and Environmental Catalysis, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

470226S	Catalytic Processes	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester, during 1 st period. It is recommended to complete the course at the fourth (1 st Master's) autumn semester.

Learning outcomes:

After the course the student is able to define the fundamentals and history of catalysis and he/she can explain the economical and environmental meaning of catalysis. The student is capable of specifying the design, selection and testing of catalysts and catalytic reactors and processes.
He/she is able to explain the most important industrial catalytic processes, the use of catalysts in environmental technology, catalyst research and the significance of an interdisciplinary approach in the preparation, development and use of catalysts. He/she recognizes the connection between catalysis and green chemistry and the role of catalysis in sustainable processes and energy production.

Contents:

Definition of catalysis and a catalyst, history of catalysis, economical, social and environmental meaning. Preparation of catalysts, principles, selection, design and testing of catalysts and catalytic reactors. Kinetics and mechanisms of catalytic reactions, catalyst deactivation. Industrially important catalysts, catalytic reactors and catalytic processes. Environmental catalysis. Catalysts in air pollution control and purification of waters. Catalysis and green chemistry. Catalysis for sustainability. Principles in the design of catalytic processes.

Mode of delivery:

Lectures including design exercises, face-to-face teaching.

Learning activities and teaching methods:

Lectures 40 h, exercises 10 h, homework 30 h, self-study 53 h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I, 488010P Introduction to Process and Environmental Engineering II, and 780109P Basic Principles in Chemistry are recommended beforehand.

Recommended optional programme components:

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Recommended or required reading:

Lecture handout; Richardson, J.T.: Principles of Catalyst Development. New York. 1989, 288 pp.; Janssen, F.J.J.G. & van Santen, R.A.: Environmental Catalysis. NIOK, Catalytic Science Series, Vol. 1. 1999. 369 pp. *Additional literature:*Ertl, G., Knözinger, J. & Weitkamp, J.: Handbook of Heterogeneous Catalysis. Vol. 1-5. Weinheim. 1997, 657 p.; Thomas, J.M. & Thomas, W.J.: Principles and Practice of Heterogenous Catalysis. Weinheim 1997. 657 pp.; Somorjai, G.A.: Surface Chemistry and Catalysis. New York 1994, 667 pp.; van Santen, R.A., van Leuwen, P.W.N.M., Mouljin, J.A. & Averill, B.A.: Catalysis: An Integrated Approach, 2nd ed. Studies in Surface Science and Catalysis 123. Amsterdam 1999, Elsevier Sci. B.V. 582 pp.

Assessment methods and criteria:

Written examination and homework.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Post-doctoral research fellow Tanja Kolli

Working life cooperation:

No

Other information:

-

488221S: Environmental Load of Industry, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Niina Koivikko

Opintokohteen kielet: English

Leikkaavuudet:

488215S	Industry and Environment	5.0 op
488205S	Environmental Load of Process Industry	4.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during 3 rd period.

Learning outcomes:

The student is able to identify the essential features of the environmental load in different types of (chemical, wood, metallurgical, etc.) industry. He/she is able to explain the type, quality, quantity and sources of the emissions. The student is familiarized with the main emission control systems and techniques in different industrial sectors. He/she has the skills to apply BAT-techniques in emission control. The student can explain the environmental management system of an industrial plant and is able to apply it to an industrial plant.

Contents:

Effluents: types, quality, quantity, sources. Unit operations in managing effluents, comprehensive effluent treatment. Environmental management systems, environmental licences, environmental reporting and BAT.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 40 h, self-study 93h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I, 488011P Introduction to Process and Environmental Engineering II, 488204S Air Pollution Control Engineering and 488110S Water and Wastewater Treatment recommended before-hand.

Recommended optional programme components:

-

Recommended or required reading:

Material represented in lectures and in the Optima environment.

Assessment methods and criteria:

Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:

University researcher Satu Ojala

Working life cooperation:

No

Other information:

Expert lecturers may be invited from industry to give specific lectures related to the organization.

488204S: Air Pollution Control Engineering, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Satu Pitkäaho

Opintokohteen kielet: English

Leikkaavuudet:

ay488204S	Air Pollution Control Engineering (OPEN UNI)	5.0 op
488213A	Sources and control of air pollution	5.0 op
480380S	Air Protection Techniques	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 nd period.

Learning outcomes:

The student is able to explain what kind of air emissions originate from certain industries and power plants, and can explain their environmental and health impacts. The student is able to explain the common air pollution control systems for different emissions (SO2, NOx, VOC, CO2, dust) and is able to design air pollution cleaning devices. He/she can describe how air emissions are measured. In addition, the student is able to describe the main laws related to air emission control.

Contents:

Effects of pollution on the atmosphere. Acid rain. Climate change. Ozone. Effects of pollution on health, nature and buildings. Legislation. Measurement of emissions. Emission control technologies, VOC emissions, SO_x emissions, NO_X emissions, heavy metals, POPs, HAPs, etc.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30h, exercises 10h and self-study 93 h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I, 488011P Introduction to Process and Environmental Engineering II and 780109P Basic Principles in Chemistry recommended beforehand.

Recommended optional programme components:

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Recommended or required reading:

Materials in the Optima environment. de Nevers; N.: Air Pollution Control Engineering. 2nd ed. McCraw-Hill 2000. 586 pp
Additional literature: Singh, H. B.: Composition, Chemistry, and Climate of the Atmosphere. New York 1995. 527 pp.; Bretschneider, B. & Kurfurst, J.: Air Pollution Control Technology. Elsevier, Amsterdam 1987. 296 pp.; Hester, R. E. & Harrison, R. M.: Volatile Organic Compound in the Atmosphere. Issues in Environmental Science and Technology. Vol. 4. Bath 1995; Hester, R. E. & Harrison, R. M.: Waste Incineration and the Environment. Issues in Environmental Science and Technology. Vol 4. Bath 1995.

Assessment methods and criteria:

Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University researcher Satu Ojala

Working life cooperation:

No

Other information:

-

488104A: Industrial and municipal waste management, 5 op

Voimassaolo: 01.08.2005 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisangela Heiderscheidt

Opintokohteen kielet: English

Leikkaavuudet:

480160S	Waste Management of Communities and Industry	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is organized in the autumn semester, during period 1

Learning outcomes:

The student will acquire a wilder view of what is waste and how it is generated and managed in communities and industries. Student will be familiar with waste management hierarchy and how waste legislation regulates waste management. She/he will get basic knowledge about waste treatment methods including their sustainability and related environmental impacts. As well as, how a series of factors influence the planning of waste management activities in industries and municipalities. The student will also be able to understand the energy and material recovery potential within the waste sector.

Contents:

Waste management hierarch, waste prevention principle, municipal waste management, waste management in industries, waste legislation, municipal and industrial waste treatment methods, international treaties related to waste management, waste to energy principle.

Mode of delivery:

Face-to-face teaching and guided assignments.

Learning activities and teaching methods:

Learning methods: A) Active learning method: Lectures (25 h), group work/ exercises (45 h), self-study for examination and completion of exercises (55 h) and field visits (8 h) or alternatively; B) BOOK examination: 100% self-study mode where the student is provided with 2-3 books as reference material and he/she attends an examination.

Target group:

Students in the Bachelor program of Environmental Engineering

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Lecture hand-outs, notes and other materials delivered in lectures; Waste management: a reference handbook illustrated edition, 2008 (electronic book, ISBN 9781598841510); Pippo, S., 2013. Municipal solid waste management in Finland. Greensettle publications. ISBN 978-952-62-0071-2.

Assessment methods and criteria:

A) Active mode: *successful completion of course work which consists of* group exercises 1 and 2 and achieving a pass grade (1-5) in the final exam which is based on lectures material and exercises; B) Self-study mode: achieving a passing grade (1-5) in the exam which is based on provided reference material. Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Researcher Elisangela Heiderscheidt

Working life cooperation:

No

Other information:

-

Optional; choose 30 ECTS

488201A: Environmental Ecology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488210A	Environmental science and technology	5.0 op
ay488201A	Environmental Ecology (OPEN UNI)	5.0 op
488406A	Introduction to Environmental Science	5.0 op
480001A	Environmental Ecology	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during 4 th period. It is recommended to complete the course at the first (Bachelor's) spring semester.

Learning outcomes:

Upon completion of the course, the student is able to define the basic concepts of environmental ecology. He/she has knowledge about the state of the environment and is able to explain the essential environmental problems and the main effects of pollution. In addition, the student knows some solutions to environmental problems and is aware of ethical thinking in environmental engineering. The student also has basic knowledge about toxicology and epidemiology.

Contents:

Principles of environmental ecology. Roots of environmental problems. Global air pollution: ozone depletion, acid deposition, global warming and climate change. Water pollution, eutrophication, overexploitation of ground and surface water. Main effects of pollution and other stresses. Non-renewable and renewable energy. Energy conservation and efficiency. Hazardous and solid waste problem. Principles of toxicology, epidemiology, and risk assessment. Environmental ethics.

Mode of delivery:

Web-based teaching.

Learning activities and teaching methods:

Book examination 80 h / exercises as individual work 53 h.

Target group:

Bachelor's degree students of environmental engineering.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I and 488011P Introduction to Environmental Engineering recommended beforehand.

Recommended optional programme components:

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Recommended or required reading:

Chiras D.: Environmental Science. New York, Jones and Bartlett Publishers, 9 th edition, 2013.

Assessment methods and criteria:

All students complete the course in a final examination. Also the exercises will be assessed. The assessment of the course is based on the learning outcomes of the course.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Virpi Väisänen

Working life cooperation:

No

Other information:

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477523S: Simulation, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477503S	Simulation	3.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish and English

Timing:

Implementation in the 2nd autumn period. Recommended for fourth (1st M.Sc.) year students

Learning outcomes:

Upon completion the student is capable of explaining the concepts and operation principles for both simulators of continuous processes and event-based simulation. The student has skills to construct simulation models in Matlab-Simulink environment and to explain the operation of these models. The student recognizes the key problems of the simulation and is able to choose suitable modeling solutions in process modeling and control. Moreover, the student is able to use key concepts of interactive and distributed simulation. After the course the student is able to search other relevant simulation languages and programming tools

Contents:

Modelling, modular and equation based simulation, dynamic simulation, intelligent methods in simulation, simulation in automation, event handling in continuous simulation, simulation of production processes, distributed simulation, integration with other systems, simulation languages and programming tools

Mode of delivery:

Tuition is implemented mainly as face-to-face teaching

Learning activities and teaching methods:

The amount of guided teaching is 32 h, including lectures (16h), exercises (10h) and seminars (6h). Totally 58 h are allocated for self-study, which consists of three parts: (1) a case study covering several topics applied in a chosen problem, (2) a seminar work concentrating on a single topic, and (3) the final report.

Target group:

M.Sc. students in process and environmental engineering, machine engineering, computer engineering and industrial engineering and management

Prerequisites and co-requisites:

Matlab programming skills are a benefit; see "Recommended optional programme components" below

Recommended optional programme components:

Programming in Matlab course reinforces abilities for the exercises and the case study

Recommended or required reading:

Lecture notes and exercise materials. Material is in Finnish and in English.

Assessment methods and criteria:

The assessment of the course is based on learning diaries, exercises, case study, seminar and the final report. Final exam is an alternative for the final report.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:

D.Sc. (Tech.) Esko Juuso

Working life cooperation:

No

Other information:

-

477209S: Chemical Process Simulation, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jani Kangas

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Autumn, periods 1-2

Learning outcomes:

The student has the ability to convert a process flow diagram into a form compatible with process simulation software. She/he has skills to evaluate realistic process conditions in a typical chemical process. The student can apply proper thermodynamic property models for simulation purposes. She/he can name the advantages and disadvantages of using the sequential modular solving approach in chemical process modelling and simulation. She/he is capable of solving a computer simulation case for a typical chemical process. The student is able to analyze the simulation results with respect to realistic values.

Contents:

The structure of a process simulator. Thermodynamic property models and databanks. Degrees of freedom analysis. Steady-state simulation. Sequential modular, and equation-oriented approaches in simulation. Numerical solving methods. Heuristics for chemical process simulation.

Mode of delivery:

Face-to-face teaching, introductory examples and group exercises with process simulation software.

Learning activities and teaching methods:

Guided exercises 32h and group work 98h

Target group:

Master's students in Chemical Engineering study option

Prerequisites and co-requisites:

477204S Chemical Engineering Thermodynamics or equivalent knowledge

Recommended optional programme components:

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Recommended or required reading:

Material distributed on lectures. Additional literature, Turton, R., Bailie, R.C., Whiting, W.B. & Shaeiwitz, J. A.: Analysis, synthesis, and design of chemical processes. 3 rd Ed. Prentice Hall. (Parts) ISBN 0-13-512966-4.

Assessment methods and criteria:

Group exercise reports and a simulation study exam performed individually.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr Jani Kangas

Working life cooperation:

No

Other information:

-

477306S: Non-ideal Reactors, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

Leikkaavuudet:

470222A	Reactor Analysis and Design II	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in the autumn semester during the 2nd period. It is recommended to complete the course at the fourth (1st Master's) autumn semester.

Learning outcomes:

After completing the course the student can analyse the effect of non-ideal mixing conditions on the behaviour of a reactor. He/she is capable of explaining the mechanisms of heterogeneous reactions, especially with methods that are used to analyse the effect of mass and heat transfer on the observed kinetics of heterogeneous reactions. The student has rudimentary skills to conduct demanding reactor analysis and to design heterogeneous reactors.

Contents:

Mixing models of a flowing material. Residence time distribution theory. Heterogeneous catalysis and biochemical reactions: mechanisms, mass and heat transfer, and reactor design. Gas-liquid reactions: mechanisms, mass transfer, and reactor design. Design heuristics. Microreactors.

Mode of delivery:

Lectures including exercises, face-toface teaching.

Learning activities and teaching methods:

Lectures 35 h, exercises 12 h, homework 12 h, self-study 74 h.

Target group:

Master’s degree students of Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

Courses 477201A Energy and Material Balances and 477202A Reactor Analysis are recommended beforehand.

Recommended optional programme components:

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Recommended or required reading:

Nauman, E.B.: Chemical Reactor Design. New York, John Wiley & Sons.1987; Winterbottom, J.M. & King, M.B. (Editors) Reactor Design for Chemical Engineers. Padstow 1999, T.J. International Ltd. 442 s. *Additional literature:* Gianetto, A. &Silveston, P.L.: Multiphase Chemical Reactors: Theory, Design, Scale-up. Hemisphere, Washington, D. 1986; Froment, G. & Bischoff, K.B.: Chemical Reactor Analysis and Design. New York, John Wiley & Sons. 1990; Hessel, V., Hardt, S. &Löwe, H.: Chemical Micro Process Engineering. Weinheim 2004, Wiley-VHC Verlag GmbH & Co. 674 p, Salmi, T., Mikkola, J.-P.&Wärnå, J. Chemical reaction engineering and reactor technology. Boca Raton 2011, CRC Press, 615 p.

Assessment methods and criteria:

Examination. Homework assignments affect the course grade. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Riitta Keiski

Working life cooperation:

No

Other information:

By means of the residence time distribution theory, students adopt a way of thinking in modeling which is based on the concept of probability.

477223S: Advanced Process Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477206S	Advanced Process Design	6.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring, period 4

Learning outcomes:

The student is able to produce a preliminary chemical process concept. She/he can apply systematic process synthesis tools, chemical process simulation tools and whole process performance criteria in the conceptual process design phase. Furthermore, the student is able to produce process design documents. The student will acquire skills how to work as a member in an industrial chemical process design project. She/he will experience by team work the hierarchical character of the conceptual process design, the benefits of the systematic working methods and the need to understand the whole process performance when optimal design is sought. The student understands the importance of innovation and creative work.

Contents:

Conceptual process design and hierarchical decision making. Heuristics of process design. Design methodology: synthesis, analysis and evaluation. Design cycle. Performance evaluation of the chemical processes. Team work and meetings.

Mode of delivery:

Design projects in small groups

Learning activities and teaching methods:

Project meetings 10h and project group work 120h

Target group:

Master's students of process and environmental engineering

Prerequisites and co-requisites:

Learning outcomes of 477203A Process Design or similar knowledge

Recommended optional programme components:

Part of Process Design Module

Recommended or required reading:

Seider, W.D., Seider, J.D. and Lewin, D.R. Product and process design principles: Synthesis, analysis and evaluation. John Wiley & Sons, 2004. (Parts) ISBN 0-471-21663-1

Assessment methods and criteria:

Project work with oral and written reporting. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

No

Other information:

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477305S: Flow Dynamics, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Muurinen, Esa Ilmari

Opintokohteen kielet: Finnish

Leikkaavuudet:

470303S	Flow Dynamics	3.5 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish, can be completed in English as a book examination (see Mode of Delivery)

Timing:

Implementation in autumn semester during 1st period. It is recommended to complete the course at the fourth (1st Master's) autumn semester.

Learning outcomes:

After completing the course the student is able to formulate the partial differential equations describing flow of fluids and to solve these equations in systems with simple geometry using difference, finite element and finite volume methods. The student is also able to formulate and solve the equations describing flow of granular material based on molecular dynamics. He/she is able to choose the experimental methods for validation of the calculated results and the methods to measure the most common properties describing fluid flow. After the course the student is able to model simple flow configurations using CFD and to design experimental systems and measurements for verifying computational results.

Contents:

Equations in fluid dynamics. Partial differential equations. Difference method. Graphical representation. Modelling the turbulence. Finite element method. Finite volume method. Molecular dynamics. Experimental fluid dynamics.

Mode of delivery:

Lectures and compulsory exercise done in small groups (in the English version, compulsory simulation exercise in small groups and a book exam, which replaces the lectures given in English)

Learning activities and teaching methods:

Lectures 25 h, and exercise 15 h, self-study 93 h. For foreign students written examination based on given literature and a simulation exercise.

Target group:

Master’s degree students of process and environmental engineering.

Prerequisites and co-requisites:

Courses 477301A Momentum Transfer or 477052A Fluid Mechanics, 031019P Matrix Algebra and 031022P Numerical Methods are recommended beforehand.

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Anderson J.D.: Computational Fluid Dynamics, McGraw-Hill, 1995, 608 p. Hämäläinen J. & Järvinen J.: Elementtimenetelmävirtauslaskennassa, CSC – Tieteellinenlaskenta Oy, 1994, 212 p. Versteeg, H.K. &Malalasekera, W.: An Introduction to Computational Fluid Dynamics, Longman Scientific and Technical, 1995, 257 p. Pöschel, T. & Schwager, T.: Computational Granular Dynamics, 2005, 322 p. Tavoularis, S.: Measurements in Fluid Mechanics, 2005, 354 p.
Additional literature: Shaw, C.T.: Using Computational Fluid Dynamics, Prentice Hall, 1992, 251 p.; Nakayama, Y. & Boucher, R.F.: Introduction to Fluid Mechanics, Arnold, 1999, 308 p.: Haataja J.,

Käpyaho, J. &Rahola, J.: Numeerisetmenetelmät. CSC – Tieteellinenlaskenta Oy, 1993, 236 p; Rathakrishnan, E.: Instrumentation, Measurements, and Experiments in Fluids, 2007, 492 p.

Assessment methods and criteria:

Examination or a learning diary and exercise.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Person responsible:

Laboratory manager Dr Esa Muurinen

Working life cooperation:

No

Other information:

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477311S: Advanced Separation Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 nd period every odd year

Learning outcomes:

After completing the course the student is able to review the most recent methods and techniques for separation and purification of components and products, e.g. in the chemical, food, and biotechnology industries. He/she is able to define the principles of green separation processes and their research status and potentiality in industrial applications.

Contents:

The course is divided into lectures given by visiting experts from different fields (industry, research institutes and universities) and seminars given by students and senior researchers. The lectures open up the newest innovations in separation and purification technologies. The lectures can include for example the following themes: Phenomena in Supercritical fluid extraction, Pressure-activated membrane processes, Reverse osmosis, Nanofiltration, Ultrafiltration, Microfiltration, Pervaporation, Polymer membranes, Dialysis, Electrolysis and Ion-exchange, Forces for adsorption and Equilibrium adsorption isotherms, Sorbent materials and heterogeneity of surfaces, Predicting mixture adsorption, Rate processes in adsorption/adsorbers and adsorber dynamics, Cyclic adsorption processes, Temperature and pressure swing adsorption. Innovative separation methods, Phenomena integration, New hybrid materials as separation agents. Fluids and their application in gas extraction processes, Solubility of compounds in supercritical fluids and phase equilibrium.Extraction from solid substrates: Fundamentals, hydrodynamics and mass transfer, applications and processes (including supercritical water and carbon dioxide). Counter-current multistage extraction: Fundamentals and methods, hydrodynamics and mass transfer, applications and processes. Solvent cycles, heat and mass transfer, methods for precipitation.Supercritical fluid chromatography.Membrane separation of gases at high pressures.The topics of the course seminars will change annually depending on the research relevance.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h, seminar work 25 h, 78 h

Target group:

Master's degree students of the Process and Environmental Engineering study programmes

Prerequisites and co-requisites:

The courses 477304A Separation Processes and 477308S Multicomponent Mass Transfer are recommended beforehand

Recommended optional programme components:

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Recommended or required reading:

The course literature will be chosen when the course is planned. Latest scientific research articles. Further literature: Green Separation Processes, Edited by: Afonso, A.M. & Crespo, J.G. 2005 Wiley-VCH, Separation Processes in the Food and Biotechnology Industries, Edited by: Grandison, A.S. & Lewis, M.J. 1996 Woodhead Publishing.

Assessment methods and criteria:

Portfolio or written examination and a seminar work including reporting and presentation.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Riitta Keiski

Working life cooperation:

No

Other information:

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477310S: Advanced Catalytic Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

Leikkaavuudet:

480360S	Catalysts in Environmental Technology	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 nd period every even year.

Learning outcomes:

After completing the course the student can explain the interdisciplinary connection of catalysis with material and surface science, define new catalyst preparation methods and application areas, catalytic reaction and process engineering, and methods in catalyst research (experimental and computational methods). He/she is also able to design and do research work by emphasising research methods and innovations in catalysis. He/she is able to explain the latest knowledge connected to catalyst research and applications. He/she is also capable of explaining the relation and differences between heterogeneous, homogeneous and biocatalysis.

Contents:

The course contents are divided into the following themes 1) surface chemistry and catalysis, 2) new catalyst preparation methods, 3) catalysis for a sustainable production and energy, and green chemistry and engineering and catalysis, 4) design of catalysts and catalytic processes (reactor and process intensification, process improvements, new catalysts and catalytic processes, new opportunities by catalysis), 5) phenomena integration and catalysis and 6) new innovations in catalyst research.

Mode of delivery:

Lectures and a seminar work, face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h, seminar work 25 h, self-study 78 h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477309S Process and Environmental Catalysis and 488204A Air Pollution Control Engineering.

Recommended optional programme components:

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Recommended or required reading:

Thomas, J.M. & Thomas, W.J.: Principles and Practice of Heterogeneous Catalysis. Weinheim 1997. 657 p.; Somorjai, G.A.: Surface Chemistry and Catalysis. New York 1994. 667 p.; Van Santen, R.A., van Leuwen, P.W.N.M., Moulijn, J.A. & Averill, B.A.: Catalysis: An Integrated Approach, 2nd. edition. Research Articles.
Further literature: Ertl, G., Knözinger, H. &Weitkamp, J.: Handbook of Heterogeneous Catalysis. Vol. 1-5. Weinheim 1997; Morbidelli, M., Gavriilidis, A. &Varma, A.: Catalyst Design, Optimal Distribution of Catalyst in Pellets, Reactors, and membranes. New York 2001, Cambridge University Press. 227 p.; Anastas, P.T. & Crabtree, R.H. (eds.): Green catalysis, volume 2: Heterogeneous Catalysis. Weinheim 2009, 338 p.

Assessment methods and criteria:

Written examination and a seminar work including reporting and presentation. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University researcher Satu Ojala

Working life cooperation:

No

Other information:

-

488206S: Sustainable Energy Project, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

488410A	Introduction to Sustainable Energy	10.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during3 th and 4 th periods

Learning outcomes:

The student is able to adapt the (skills) tools learned in previous courses to complete an energy production and management design project. The student will solve an engineering problem related to sustainable energy generation in cold climate.The student is able to describe the key practical issues related to sustainable energy generation. The student will evaluate the relevant instruments, tools and measures required for sustainable energy production, distribution, and end-use efficiency. The student will demonstrate the ability to select the proper tools, and methods to solve the design problem. The student will also acquire skills to work as a member in an engineering design project as part of a team. He/she will gain the experience to carry out a real project and produce a documentation of the engineering solution.

Contents:

A design project to adapt small-scale renewable energy production and management, greenhouse gas reduction and/or utilization, wind, solar, and geothermal energy generation. Management of energy efficiency. Energy engineering and design principles. Performance evaluation and sustainability assessment of the selected project. Problem solving.

Mode of delivery:

Team work, group meetings and seminars

Learning activities and teaching methods:

Lectures, design projects in small groups, presentations and reporting.

Target group:

Master's degree students of the degree programmes of Process Engineering and Environmental Engineering

Prerequisites and co-requisites:

The course 488202 Production and Use of Energy is a compulsory, and 488203S Industrial Ecology and 477309S Process and Environmental Catalysis courses are recommended prerequisites to the project

Recommended optional programme components:

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Recommended or required reading:

Materials delivered on lectures and during the group meetings. *Additional literature:* Manuals and databases, depends on the project work selected.

Assessment methods and criteria:

Written report with the documentation of the engineering solution.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Mika Huuhtanen

Working life cooperation:

No

Other information:

-

A432226: Module of Option/Basic Module of Water and Environment, 30 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

030008P: Information Skills for foreign degree students, 1 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Faculty of Technology
Arvostelu: 1 - 5, pass, fail
Opettajat: Sassali, Jani Henrik, Ursula Heinikoski
Opintokohteen kielet: English

Ei opintojaksokuvauksia.

900017Y: Survival Finnish Course, 2 op

Voimassaolo: 01.08.1995 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuyksikkö: Negotiated Education
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay900017Y	Survival Finnish Course (OPEN UNI)	2.0 op

Proficiency level:

A1.1

Status:

The course is intended for the international students in every faculty of Oulu University.

Required proficiency level:

No previous Finnish studies.

ECTS Credits:

2 ECTS credits

Language of instruction:

Finnish and English

Timing:

-

Learning outcomes:

By the end of the course the student can understand and use some very common everyday expressions and phrases, and s/he can locate informational content in simple texts and messages. The student also knows the basic characteristics of Finnish language and Finnish communication styles.

Contents:

This is an introductory course which aims to help students to cope with the most common everyday situations in Finnish. During the course, students learn some useful everyday phrases, some general features of the vocabulary and grammar, and the main principles of pronunciation.

The topics and communicative situations covered in the course are: general information about the Finnish language, some politeness phrases (how to greet people, thank and apologize), introducing oneself, giving and asking for basic personal information, numbers, some time expressions (how to tell and ask the time, days of the week, time of day), food, drink and asking about prices.

The structures studied are: personal pronouns and their possessive forms, forming affirmative, negative and interrogative sentences, the conjugation of some verbs, the basics of the partitive singular and some local cases for answering the 'where'-question.

Mode of delivery:

Multi-modal teaching (Contact teaching, on-line teaching and independent work)

Learning activities and teaching methods:

Lessons 1–2 times a week (12–14 h) and guided self study (36 h)

Target group:

International degree and post-graduate degree students and exchange students of the University

Prerequisites and co-requisites:

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Recommended optional programme components:

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Recommended or required reading:

Will be provided during the course.

Assessment methods and criteria:

Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Grading scale is 1-5.

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

Sign-up in WebOodi.

900013Y: Beginners' Finnish Course 1, 3 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Negotiated Education

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900013Y	Beginners' Finnish Course 1 (OPEN UNI)	2.0 op

Proficiency level:

A1.2

Status:

The course is intended for the international students in every faculty of Oulu University.

Required proficiency level:

A1.1, Completion of the Survival Finnish course (900017Y) or the equivalent language skills.

ECTS Credits:

3 ECTS credits

Language of instruction:

As much Finnish as possible; English will be used as a help language.

Timing:

-

Learning outcomes:

By the end of the course the student can understand and use some familiar and common everyday expressions relating to her/himself and everyday situations. S/he can interact in a simple way provided the other person talks slowly and clearly and is willing to help. The student is able to read short simple texts and messages dealing with familiar topics. S/he also deepens her/his understanding of the Finnish language and communication styles.

Contents:

This is lower elementary course which aims to help students to learn communication skills in ordinary everyday situations. During the course, students broaden their vocabulary and knowledge of grammar and principles of pronunciation. They also practise to understand easy Finnish talk about everyday subjects, and reading and writing short and simple texts/messages.

The topics and communicative situations covered in the course are: talking about oneself, one's family, studies and daily routines, as well as asking about these things from other person, expressing opinions, describing people and things, talking about weather and seasons, the names of the months and colours.

The structures studied are: verb types, basics of the change of the consonants k, p and t in verbs and nouns, the genitive and partitive cases, possessive structure, some declension types for nouns (word types) and the basics of the local cases.

Mode of delivery:

Contact teaching and guided self study

Learning activities and teaching methods:

Lessons 2 times a week (26 h) and guided self study (50 h)

Target group:

International degree and post-graduate degree students and exchange students of the University

Prerequisites and co-requisites:

Completion of the Survival Finnish Course

Recommended optional programme components:

-

Recommended or required reading:

Gehring, S. & Heinzmann, S. Suomen mestari 1 (chapters 3 - 5)

Assessment methods and criteria:

Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Grading scale is 1-5.

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

Sign-up in WebOodi. The course will start right after the Survival Finnish course.

488400A: Orientation to the BEE studies, 0 - 1 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kirsi *Marita Puikkonen

Opintokohteen kielet: English

ECTS Credits:

0 cr

Language of instruction:

English

Timing:

Implementation in the autumn semester during the 1 st and 2 nd periods.

Learning outcomes:

After completion of the different parts of this orientation, the student is able to recognize his/her own study environment in the University of Oulu and the study fields of Process Engineering and Environmental Engineering. He/she can make use of the student services of the university. He/she will be able to draft a personal study plan and schedule together with the programme Study Advisor. The student is also able to use the facilities of academic libraries and other student services at the university. He/she will be able to access the tools needed for the studies and in every-day-life.

Contents:

Orientation Days for the New International Students event; Introduction to studies, overview of the services offered by the university, and the student organizations (e.g. academic sports services, student health services); Introduction to the university, faculty and study fields in relation to the BEE studies; Introduction to the methods of studying and to the skills in gaining the tools needed for planning of the studies; Overview of library, Optima, etc. services. Other issues based on the needs of the individual students.
Compulsory parts: 1. the Orientation Days for all new international students organized by the University of Oulu, containing an one day by the study programme. 2. Orientation to the BEE master’s degree programme. 3. Participation to student tutoring during the autumn term. 4. Planning of PSP (personal study plan) and study schedule, and ratification of the BEE study option Clean Production or Water and Environment.

Mode of delivery:

Implemented mainly as face-to-face teaching, or by distance learning.

Learning activities and teaching methods:

Lectures, visits, seminars, exercises, etc.

Target group:

The new students of the Master's Degree Programme (BCBU) in Environmental Engineering (BEE) only.

Prerequisites and co-requisites:

For BEE students, admission to the Master's programme, for which minimally a former bachelor's degree is required.

Recommended optional programme components:

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Recommended or required reading:

All materials will be delivered on need-basis (e.g. BEE-study guide book, etc.)

Assessment methods and criteria:

Active participation to all of the different parts of the course; planning the first version of the PSP and the schedule for the 1 st study year together with the Study Advisor (compulsory).
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

Verbal scale Passed/Failed

Person responsible:

BEE Study Advisor Marita Puikkonen (Faculty of Technology, University of Oulu)

Working life cooperation:

No

Other information:

This course is compulsory, even if no credits can be attained by it.

477005S: Advanced Practical Training, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Practical training

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

485002S	Advanced Practical Training	5.0 op
488002S	Advanced Practical Training	3.0 op
477002S	Advanced Practical Training	3.0 op

ECTS Credits:

5 ECTS**,** 2 months working full-time

Language of instruction:

Finnish or English

Timing:

Student usually works during the summer time

Contents:

During the practical training the student will acquaint themselves with the working environment from the point of view of his/her studies and with another possible future job, or with a different assignment already in a familiar working environment. He/she can identify the problems of the working environment and can solve them. The student can apply his/her theoretical knowledge in practical tasks. He/she identifies the tasks appropriate for the Master of Science in Technology at his/her workplace.

Mode of delivery:

Working as employee

Learning activities and teaching methods:

Students will find the training positions themselves. Suitable areas for practical training are, for example, regional environment centers, environmental engineering and consulting offices, water-works, biotechnological and food industry, chemical industry, pulp and paper industry, metallurgical and mining industry, partly electronics and automation industry, and other areas in the private and public sectors.

Target group:

Master’s students in Process and Environmental Engineering

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

-

Assessment methods and criteria:

Practical training, seminar presentation reporting their summer job. Student has to present his/her original references and submit an application form to the supervisor of the seminar. The reference must include the training period (from - to) and the duties.

Grading:

Verbal scale Passed/Failed

Person responsible:

Student councellor Saara Luhtaanmäki

Working life cooperation:

Yes

Other information:

The objective is to get a deeper and more detailed conception of the industrial area where the student will possibly work after graduation. Suitable tasks would be supervision tasks and R&D tasks.

488401A: Introduction to the Barents Region, 2 op

Voimassaolo: 01.01.2009 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kirsi *Marita Puikkonen

Opintokohteen kielet: English

ECTS Credits:

2 ECTS credits / 54 hours of work

Language of instruction:

English

Timing:

Implementation in the autumn semester during the 1 st period

Learning outcomes:

After the completion of this course, the student will be able to tell where and what the Barents Region is, describe the main environmental, historical, cultural and socio-economic and health issues related to it including also the special technological and infrastructural factors therein, and evaluate those against the respective issues in his/her country of origin.

Contents:

The Barents environment; History of the Barents collaboration and the political and economic profile of the Barents Region; Infrastructure and building in the Barents Region; People, cultures and livelihoods in the Barents Region; People and health at the Barents Region; Technological challenges and possibilities in the Barents Region.

Mode of delivery:

Implemented as face-to-face teaching, and by distance learning.

Learning activities and teaching methods:

Theme lectures by visiting lecturers, discussions, visits, learning diaries, and a final portfolio.

Target group:

Especially, but not strictly restricted, to the new students of the Master's Degree Programme (BCBU) in Environmental Engineering (BEE).

Prerequisites and co-requisites:

For BEE students, admission to the Master's programme, for which minimally a former bachelor's degree is required. For other students the Bachelor level studies in process or environmental engineering or respective knowledge.

Recommended optional programme components:

-

Recommended or required reading:

Lecture materials are provided during the course and in Optima.

Assessment methods and criteria:

Active participation to the lectures and visits, writing learning diaries therein and a final portfolio.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

BEE Study Advisor Marita Puikkonen (Faculty of Technology, University of Oulu)

Working life cooperation:

No

Other information:

-

488402A: Sustainable Development, 3 op

Voimassaolo: 01.01.2009 - 31.07.2015

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488402S	Sustainable Development	5.0 op

Recommended optional programme components:

Other information:

This course's description can be found by the code 488402S

477307S: Research Methodology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

480311S	Research Methodology	3.5 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn and spring semesters during periods 1-4.

Learning outcomes:

After the course the student is able to define the role of research and different stages of research work. The student is also able to classify the stages and the subtasks of research work as well as important elements related to research, i.e. literature search, experimental work, and data processing. In addition, the student can evaluate the amount of work needed in research stages. The student can write scientific text and use references appropriately. The student also has the ability to recognise ethical issues related to research and analyse the meanings of those. He/she can use the principles of good scientific practises and is able to apply knowledge to research work.

Contents:

1) Science and research politics. 2) Research education. 3) Fundamentals of philosophy of science. 4) Starting research work: research types, funding, the process of research work, finding the research area, choosing the research topic, information sources. 5) Research plan and collecting data, experimental methods and significance of the variables, systematic experimental design, collecting experimental data, test equipment, reliability of the results, problems in laboratory experiments, modelling and simulation. 6) Mathematical analysis of results. 7) Reporting: writing a scientific text, referring, writing diploma, licentiate and doctoral theses, or reports. 8) Other issues connected to research work: ethical issues, integrity, and future. 9) Examples of scientific research in practice.

Mode of delivery:

Miniproject based on lectures in Optima during autumn term, contact lectures, laboratory training period during spring term.

Learning activities and teaching methods:

Contact lectures 6 h, miniproject 15 h, training period 70 h, self-study 42 h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

None

Recommended optional programme components:

-

Recommended or required reading:

Melville, S & Goddard, W: Research Methodology; An Introduction for Science and Engineering Students. Kenwyn 1996, Juta & Co. Ltd. 167 p. Hirsijärvi, S., Remes, P. & Sajavaara, P.: Tutki ja kirjoita. Jyväskylä 2004, GummerusKirjapaino Oy. 436 p. Material introduced in the lectures.
Additional literature : Paradis, J.G. & Zimmermann, M.L.: The MIT Guide to Science and Engineering Communication, 2nd ed. Cambridge 2002, The MITPress, 324 p. Nykänen, O.: Toimivaa tekstiä, Opas tekniikasta kirjoittaville. Helsinki 2002, Tekniikan Akateemisten Liitto TEK. 212 p.

Assessment methods and criteria:

Optima exercises (miniproject) and laboratory training.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Mika Huuhtanen

Working life cooperation:

No

Other information:

The objective of the course is to familiarise the student with scientific research, scientific methods and data handling, especially in process and environmental engineering. The course will give the student the basis to do the research work and motivates him/her to begin post-graduate studies. The course gives the student team working skills and increases the co-operation between the students and the research and teaching staff. The students are exposed to experiences in co-operation between different fields of science, industry, and other universities and laboratories, as well as the skills for doctoral studies.

477041S: Experimental Design, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Implementation in the 3rd period (spring term)

Learning outcomes:

After this course the student knows the main methods and software tools for experiment design and is able to use them. He can apply the main approaches for studying and evaluating the measurement reliability.

Contents:

Determining the uncertainty of measurements in chemical, physical and biochemical measurements, measurements reliability and traceability; Calculation examples support the learning of the assessment preparation for measurements uncertainty; Experimental design preparation and execution in process analysis and optimization. Test methods and variable significance, reliability of experimental data; Practical experiment design exercise using a simulation model and Modde software.

Mode of delivery:

Lectures and practical work

Learning activities and teaching methods:

Contact lectures

Target group:

Master's students in the study programmes of Process or Environmental Engineering; exchange students; doctoral students

Prerequisites and co-requisites:

No prerequisites

Recommended optional programme components:

-

Recommended or required reading:

Reading materials given during the lectures

Assessment methods and criteria:

Assessment during the course by continuous evaluation: lecture exams and the written report of the practical work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

-

477203A: Process Design, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jani Kangas

Opintokohteen kielet: English

Leikkaavuudet:

480310A	Fundamentals of Process Design	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring period 4

Learning outcomes:

By completing the course the student is able to identify the activities of process design and the know-how needed at different design stages. The student can utilise process synthesis and analysis tools for creating a preliminary process concept and point out the techno-economical performance based on holistic criteria.

Contents:

Acting in process design projects, safety and environmentally conscious process design. Design tasks from conceptual design to plant design, especially the methodology for basic and plant design.

Mode of delivery:

Lectures and design exercises.

Learning activities and teaching methods:

Lectures 30h, group work 50h and self-study 50h

Target group:

Bachelor students

Prerequisites and co-requisites:

Objectives of 477202A Reactor analysis and 477304A Separation processes

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout, Seider, W.D., Seider, J.D. and Lewin, D.R. Product and process design principles: Synthesis, analysis and evaluation. John Wiley & Sons, 2004. (Parts) ISBN 0-471-21663-1

Assessment methods and criteria:

Combination of examination and design exercises.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

Scale 0-5

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

-

Other information:

-

A432276: Advanced Module/Water and Environment, 60 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

488102A: Hydrological Processes, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay488102A Hydrological Processes (OPEN UNI) 5.0 op
480207A Hydraulics and Hydrology 5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish, course can also be completed in English as a self-study/book exam

Timing:

The course unit is given in the autumn semester during period 1. Also the English version of the course is only available in the autumn semester.

Learning outcomes:

After the course, the student understands and can describe the main hydrological processes, water movements and hydraulics phenomenon quantitatively through mathematical methods. The student also understands and quantifies the relation between state and flow with relation to snowmelt, evaporation, infiltration and groundwater flow. After couse student have knowledge also to design pipe and open channel projects.

Contents:

Hydrological cycle, physical properties of water, distribution of water resources, water balance, precipitation, evapotranspiration, soil and ground water, infiltration, runoff, snow hydrology, hydrometry, water quality of rivers and lakes, open channel flow, flow in pipe systems.

Mode of delivery:

Face-face teaching in Finnish, self-study package in English

Learning activities and teaching methods:

For the English self-study package, 4 tutor sessions are arranged during the autumn semester

Target group:

Students in international programs of environmental engineering

Prerequisites and co-requisites:

No

Recommended optional programme components:

The course is a prerequisite for Master level studies

Recommended or required reading:

Physical Hydrology (Dingman SL, 2002, 2nd Edition, ISBN 978-1-57766-561-8), Fluid Mechanics and Hydraulics (Giles, Evett and Liu, 3rd Edition, ISBN 0-07-020509-4)

Assessment methods and criteria:

Both hydrology and hydraulics assignments must be returned and passed with threshold of 50% in order to get final examination. The final grade of the course is weighted average of assignments (80%) and examination (20%)

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Read more about assessment criteria at the University of Oulu webpage.

Person responsible:

University Lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

-

488108S: Groundwater Engineering, 5 op

Voimassaolo: - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Björn Klöve

Opintokohteen kielet: English

Leikkaavuudet:

480122A	Groundwater Technology	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the spring semester, during period 4

Learning outcomes:

Upon completion of the course, the student will have knowledge on water retention and flow in soils, basic theories about hydraulics of groundwater systems, groundwater quality, groundwater use and modelling. Students learn to define hydraulic characteristics of soil and aquifers. After the course students are able to estimate key factors influencing on discharge and water quality of groundwater and to use general methods to calculate groundwater flow. They also know how to plan, manage, and protect groundwater resources in a sustainable way.

Contents:

Soil and groundwater, water balance, hydraulic properties of soils, formation of groundwater, flow equations and solutions, pumping tests and methods, groundwater quality and modelling.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 10 h, calculus exercises 9 h, MODFLOW modelling exercises 16 h, modelling report 40 h, and self-study 60 h

Target group:

Master students in the Water Engineering study options of the Environmental Engineering program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes

Recommended optional programme components:

-

Recommended or required reading:

Lecture handouts, Physical and Chemical Hydrogeology (Domenico PA, Schwartz FW, 2nd edition, 1998, ISBN 0-471- 59762-7). Maanalaiset vedet - pohjavesigeologi-an perusteet (Korkka-Niemi K, Salonen V-P, 1996, ISBN 951-29-0825-5). Pohjavesi ja pohjaveden ympäristö (Mälkki E, 1999, ISBN 951-26-4515-7).

Assessment methods and criteria:

Modelling assignment (40 % of the grade) and exam (60 % of the grade).
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Postdoctoral Researcher Pekka Rossi

Working life cooperation:

No

Other information:

-

488110S: Water and Wastewater Treatment, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisangela Heiderscheidt

Opintokohteen kielet: English

Leikkaavuudet:

480151S	Water and Wastewater Treatment	7.0 op
480208S	Industrial Water and Wastewater Treatment	3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, during period 1

Learning outcomes:

Upon completion of the course, the student will be able to understand the theory and practicalities of the most used processes in water and wastewater treatment. The student will also be capable to perform basic dimensioning calculations and therefore he/she will be able to dimension structures/units of water and wastewater treatment plant processes.

Contents:

Water quality characteristics of source water; basic principles of purification processes (coagulation/flocculation, sedimentation, biological treatment, filtration, disinfection, etc.); used process units in water and waste water treatment; selection of process units; dimensioning of treatment units and unit processes..

Mode of delivery:

Mix of guided self-study work and face-to-face teaching and field visits

Learning activities and teaching methods:

Lectures (20 h), field visits (5 h), exercises ( ), self-study (60 h)

Target group:

Students in the Master program of Environmental Engineering

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering I (477011P) and II (488010P)

Recommended optional programme components:

-

Recommended or required reading:

Lecture hand-outs, & "Lindquist, A., 2003. About water treatment. Helsingborg: Kemira Kemwater". Optional: RIL 124-2, Vesihuolto II; Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse; AWWA, Water quality & treatment; AWWA, Water treatment plant design.

Assessment methods and criteria:

The course can be completed: A) Active mode: midterm exam based on reading material + completion of 2 group exercises + final exam based on lectures and exercises; B) BOOK exam: 100% self-study mode where the student is provided with 2-3 reference books and attends an exam based on the provided material.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Researcher Elisangela Heiderscheidt

Working life cooperation:

No

Other information:

-

488127S: Field measurements, site investigations and geotechnical tests, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given during periods 1 and 2

Learning outcomes:

Upon completion the student should be able to design field measurements and understand the quality of sampling and measurements in the field of environmental engineering. The student also improves skills of working in a team of fellow students to share expertise and execution responsibilities. The student understands the laboratory testing procedures and the associated parameters that help in estimating the soil mechanics and Geotechnical engineering and. The student knows how to use different methods for field measurement and sampling in water and geotechnical issues. The student can take considering the safety during the laboratory works and field measurements. After the course, the student can write detailed engineering reports.

Contents:

In the lectures: Units of measurements, Error and mistake in laboratory works and field measurements, random and systematic error, precision and accuracy in laboratory work, planning field works, description of measuring site, Securing results and material, sample preservation, subsoil exploration, direct & indirect

methods of exploration, disturb and undisturbed samples, Safety in field work, introduction on surveying, leveling, map and scale.
In laboratory: Laboratory works on Geotechnical and Geoenvironmental Engineering contain sieving test, hydrometer test, Atterberg limits test, proctor test, direct shear box test and eudiometer test. Field measurement experiences in cold climate.
In the field: Working with GPS. Levelling and collecting data for preparing topography map. Soil and water sampling. Ground water sampling. Measuring velocity and discharge of river.

Mode of delivery:

Face-to-face teaching, laboratory working

Learning activities and teaching methods:

Activating learning method: Lectures (15 h), group work (120 h)

Target group:

Master students in the Water and Geo Engineering and Water and Environment study options

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488115A Geomechanics

Recommended optional programme components:

-

Recommended or required reading:

Field measurements and Laboratory work instruction, lecture materials

Assessment methods and criteria:

Each exercise is evaluated graded on the scale 1-5. The final grade of the course is weighted average of following parts: participate in the lectures (5%), participate in the laboratory and field works (20% if the respective report will be presented), assignments (8%), and reports (50%), Exam (15%).

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Teacher Ali Torabi Haghighi

Working life cooperation:

No

Other information:

-

488128S: Laboratory tests in water resources engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given during the spring periods 3 and 4

Learning outcomes:

Upon completion this course, the student improves their skills of working in a team of fellow students to share expertise and execution responsibilities. The student understands the laboratory testing procedures and the associated parameters that help in estimating the water, and waste water properties. The laboratory work contains 3 main parts: fluid mechanics and open channel, water and waste water and ground water engineering.

Contents:

In the lectures: Units of measurements, error and mistake in laboratory works, how to write lab report, safety in laboratory, calibration, introduction to laboratory test in fluid mechanics and open channel hydraulics, introduction to laboratory tests in water and waste water engineering and introduction to groundwater engineering.
In laboratory: Laboratory works on Fluid mechanics and open channel hydraulics contain different method for discharge measurement, Bernoulli equation, Momentum equation, reservoir outflow, Pump and pumping, gates and wires, hydraulic jump and tracer test. Laboratory works on Ground water engineering contain hydraulic conductivity (K), specific yield (S), porosity (n) and PF curve test, Darcy low and groundwater flow, contaminant transport. Laboratory works on water and waste water engineering contain Jar test experiment, settling velocity, limestone ($CaCO_3$) filtration, aeration determination of Fe, Cl^-, Mn.

Mode of delivery:

Face-to-face teaching, laboratory working

Learning activities and teaching methods:

Activating learning method: Lectures (10 h), group work (120 h)

Target group:

Master students in the Water and Geo Engineering and Water and Environment study options

Prerequisites and co-requisites:

The required prerequisite is the completion of the following courses prior to enrolling for the course unit: 488102 Hydrological Processes, 488108S Groundwater Engineering, 488110S Water and Wastewater Treatment, 488113S Introduction to Surface Water Quality Modelling

Recommended optional programme components:

-

Recommended or required reading:

Field measurements and Laboratory work instruction, lecture materials

Assessment methods and criteria:

Each exercise is evaluated graded on the scale 1-5. The final grade of the course is weighted average of following parts participate in the lectures (5%), participate in the laboratory (20% if the respective report will be presented), assignments (10%), and reports (50%), Exam (15%).

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Teacher Ali Torabi Haghighi

Working life cooperation:

No

Other information:

-

488117S: Water Resources Management, 5 - 7,5 op

Voimassaolo: - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannu Marttila, Ali Torabi Haghighi

Opintokohteen kielet: English

Leikkaavuudet:

480170S Environmental Impact Assesment and Diminishing Harmful Effects in Water Resource Management 5.0 op

480212S Environmental Construction 3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, during period 2

Learning outcomes:

This course introduces design concepts and principles that must be taken into account in planning of sustainable use of water resources. After the course students understand different processes, principles and mathematical methods used to manage water resources issues.

Contents:

Different water uses and interests, hydropower and dam engineering, irrigation and drainage, flood control and management, river restoration cases, sediment transport problems, peatland land use, acid sulphate soils, optimization and simulation, lake restoration, socio-ecological aspects in water resources.

Mode of delivery:

Face-to-face teaching, assignments

Learning activities and teaching methods:

Variable learning methods: Lectures and assignments

Target group:

Master students in the water engineering study options of Environmental Engineering program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes

Recommended optional programme components:

-

Recommended or required reading:

Water Resources Systems Planning and Management: An Introduction to Methods, Models and Applications. (Loucks and van Beek, 2005, ISBN 92-3-103998-9)

Assessment methods and criteria:

Variable assessment methods where each submission is graded and weighted separately: Assignment 1 (30%), Assignment 2 (20%) and Assignment 3 (50%). More detailed instructions will be given in the course. Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

D.Sc. (Tech.) Hannu Marttila

Working life cooperation:

No

Other information:

The course is arranged in alternate years (odd autumn semesters)

488104A: Industrial and municipal waste management, 5 op

Voimassaolo: 01.08.2005 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisangela Heiderscheidt

Opintokohteen kielet: English

Leikkaavuudet:

480160S	Waste Management of Communities and Industry	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is organized in the autumn semester, during period 1

Learning outcomes:

The student will acquire a wilder view of what is waste and how it is generated and managed in communities and industries. Student will be familiar with waste management hierarchy and how waste legislation regulates waste management. She/he will get basic knowledge about waste treatment methods including their sustainability and related environmental impacts. As well as, how a series of factors influence the planning of waste management activities in industries and municipalities. The student will also be able to understand the energy and material recovery potential within the waste sector.

Contents:

Waste management hierarch, waste prevention principle, municipal waste management, waste management in industries, waste legislation, municipal and industrial waste treatment methods, international treaties related to waste management, waste to energy principle.

Mode of delivery:

Face-to-face teaching and guided assignments.

Learning activities and teaching methods:

Learning methods: A) Active learning method: Lectures (25 h), group work/ exercises (45 h), self-study for examination and completion of exercises (55 h) and field visits (8 h) or alternatively; B) BOOK examination: 100% self-study mode where the student is provided with 2-3 books as reference material and he/she attends an examination.

Target group:

Students in the Bachelor program of Environmental Engineering

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Lecture hand-outs, notes and other materials delivered in lectures; Waste management: a reference handbook illustrated edition, 2008 (electronic book, ISBN 9781598841510); Pippo, S., 2013. Municipal solid waste management in Finland. Greensettle publications. ISBN 978-952-62-0071-2.

Assessment methods and criteria:

A) Active mode: *successful completion of course work which consists of* group exercises 1 and 2 and achieving a pass grade (1-5) in the final exam which is based on lectures material and exercises; B) Self-study mode: achieving a passing grade (1-5) in the exam which is based on provided reference material. Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Researcher Elisangela Heiderscheidt

Working life cooperation:

No

Other information:

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488133A: Environmental Impact Assessment, 5 op

Voimassaolo: 01.08.2015 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488103A	Environmental Impact Assessment	4.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given in the autumn semester, during period 1

Learning outcomes:

The student will acquire a broad and multidisciplinary and sustainable approach to environmental impact assessment (EIA). The student will know the all steps in EIA process and the different methods used in environmental impact assessment. During the course students develop their working life skills (e.g. writing, communication and presentation skills) and the ability to review environmental problems. Thy also learn how to resolve extensive environmental projects related problems, causes and consequences.

Contents:

EIA process and legislation, environmental change, principles and assessment methods in ecology, hydrology, economics and social sciences

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

The course contains lectures (20 h), seminars (9 h) and independent works (106 h)

Target group:

Master students in the Environmental Engineering study program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering I (477011P) and II (488010P)

Recommended optional programme components:

-

Recommended or required reading:

Environmental Impact Assessment: Cutting Edge for the Twenty-First Century (Gilpin A, 1995, ISBN 0-521-42967-6). Lecture hand-outs and other materials delivered in lectures.

Assessment methods and criteria:

The assignement (60 %) and seminar (40%). More information about assessment methods of each module is given during the course.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

The course is arranged in alternate years (even autumn semesters). The course is organised in a co-operation with the Faculty of Technology and the Thule Institute.

488113S: Basics of surface water quality modelling, 5 op

Voimassaolo: - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Anna-Kaisa Ronkanen

Opintokohteen kielet: English

Leikkaavuudet:

480210S	Environmental Impacts of Industrial Effluents	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given in the autumn semester, during period 2

Learning outcomes:

The student knows the main transport mechanisms and will be able to model water quality in lakes and streams. The students will be able to use Matlab in environmental analysis, modeling and programming.

Contents:

Introduction to modelling in water resources planning, environmental hydraulics, open channel flow, lake hydraulics, processes and water quality, dimensional analysis, hydraulic experiments, transport of conservative and reactive solutes in rivers. Modelling with ordinary differential equations, fully mixed systems, analytical and numerical methods for surface water modelling. Parameter estimation and uncertainty.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 25 h, exercises by Matlab 16 h, self-studies 94 h. Totally 135 h.

Target group:

Master students in the water engineering study options of the Environmental Engineering program

Prerequisites and co-requisites:

Basic university level knowledge of mathematics and physics is required. The required prerequisite is also the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes

Recommended optional programme components:

Matlab courses are recommended before the course unit

Recommended or required reading:

Surface Water Quality Modelling (Chapra S, 1996, ISBN 0-0701-1-364-5). Fluvial Hydraulics: Flow and Transport Processes in Channels of Simple Geometry. (Walter HG, 1998, ISBN 0-0471-97714-4). Environmental Hydraulics of Open Channel Flows (Chanson H, 2004, ISBN 0-7506-6165-8). Lecture hand-outs and other materials delivered in lectures.

Assessment methods and criteria:

Totally 4 assignments and examination must be done and are graded on the scale 1-5. The final grade of the course is average grade of them.

Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

The course is arranged in alternate years (even autumn semesters).

488122S: Statistical Methods in Hydrology, 5 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Björn Klöve, Hannu Marttila

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, during period 2

Learning outcomes:

By completing the course, students will be able to understand and apply most common statistical methods used in hydrology. Students gain experience in using statistical software to solve problems for large hydrological datasets. With the software, students can present their findings with various plots which are conventional in statistical hydrology and water resources management. During the course students will be further familiarized with scientific writing and reporting.

Contents:

Course uses hydrological and meteorological data to cover topics:1) Summary statistics like mean, maximum, minimum, median, standard deviation and etc. 2) Probability distributions (normal, gamma, log-normal and generalized extreme value) visualized with histograms, box plots, and CDF's and used in recurrence analyses. 3) Analyzing statistical significance of correlations between hydrological and meteorological variables. 4) Building and visualizing regression models and estimating the validity of the established models. 5) Trend and time series analysis using plots and statistical autoregression models.

Mode of delivery:

Face-to-face teaching, independent assignments

Learning activities and teaching methods:

In total, 135 hours of learning activities consisting of lectures (9 h), instructed computer sessions (18 h), and return assignments (108 h)

Target group:

Master students in the water engineering study options of the Environmental Engineering program

Prerequisites and co-requisites:

The prerequisite is the completion of the following courses: 488102A Hydrological Processes, and 477033A Programming in Matlab or corresponding Matlab skills

Recommended optional programme components:

-

Recommended or required reading:

Helsel, D.R., & Hirsch, R.M., 2002. Statistical Methods in Water Resources (available online). Loucks, D. P., van Beek, E., Stedinger, J.R., Dijkman J.P.M., Villars, M.T., 2005. Water Resources Systems Planning and Management (available online).

Assessment methods and criteria:

A) reports of group work on 3 return assignments (each 25% of the final grade), and B) final exam (25% of the final grade))
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Final grade of the course is average of assignments and final exam. In the numerical scale zero stands for a fail.

Person responsible:

Professor Björn Klöve

Working life cooperation:

No

Other information:

The course is arranged in alternate years (odd autumn semesters)

488123S: River Engineering and Hydraulic Structures, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ali Torabi Haghighi

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester during period 2

Learning outcomes:

Upon completion the student should be able to applied the pervious learned courses (open channel Hydraulics, fluid mechanics and hydrology) in hydraulic structures design and river engineering, cclassify the hydraulic structures, purposes and functions of them and design hydraulic structures using river analysis software. The student knows structures for flood protection.

Contents:

Review of hydrology, open channel hydraulics and fluid mechanics, General Requirements and Design Considerations, River geomorphology and river engineering, Flood, managing and damage assessment, Erosion and sediment transport in river, River analysis system by using Hec-Ras, River stability and flood control structure Conveyance structures, Water storage structures, Protective structures, Regulating structures, Water measurement structures, Energy Dissipaters, Hec-Ras software in hydraulic structure design.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Activating learning method: Lectures (24 h), group work (35 h), independent work (30 h), self-study (40 h) and seminar (3 h)

Target group:

Master students in the water engineering study options of the Environmental Engineering program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes

Recommended optional programme components:

The course 488113S Introduction to Surface Water Quality Modelling is recommended to take before this course unit

Recommended or required reading:

Novak, P., Moffat, A. Nalluri, C. and Narayanan, R., Hydraulic Structures, 3rd ed., 2001. U.S. Bureau of Reclamation, Design of Small Dams, U.S. Government Office, 1987. U.S. Bureau of Reclamation, Design of Small canal structures, U.S. Government Office, 1974. Lecture hand-outs.

Assessment methods and criteria:

Modelling with river analysis software and technical project (40%), assignment (30%), river engineering report (30%)
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Björn Klöve and University Teacher Ali Torabi Haghighi

Working life cooperation:

No

Other information:

The course is organised every second year (on even autumn terms)

488124S: Advanced Course in Hydrology, 5 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Björn Klöve

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given in the autumn semester, during period 1

Learning outcomes:

In-depth knowledge on hydrology

Contents:

Hydrological processes, evapotran-spiration, climate variability and extreme events, rainfall-runoff modeling, isotope hydrology

Mode of delivery:

Face-to-face teaching and independent work with assignments

Learning activities and teaching methods:

Guided and independent process studies and modelling

Target group:

Master students in the water engineering study options of Environmental Engineering program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes, 488122S Statistical Methods in Hydrology

Recommended optional programme components:

-

Recommended or required reading:

Delivered during the course

Assessment methods and criteria:

-
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Björn Klöve

Working life cooperation:

No

Other information:

The course is arranged in alternate years (even autumn semesters)

480429S: Maturity Test / Environmental Engineering, 0 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

H431595: Supplementary Studies, Environmental Engineering, 10 - 60 op

Voimassaolo: 01.01.2011 -
Opiskelumuoto: Other Entity
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Bridge Studies

031010P: Calculus I, 5 op

Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Ilkka Lusikka
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay031010P	Calculus I (OPEN UNI)	5.0 op

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Autumn semester, periods 1-3.

Learning outcomes:

After completing the course the student identifies concepts of vector algebra and can use vector algebra for solving problems of analytic geometry. The student can also explain basic characteristics of elementary functions and is able to analyse the limit and the continuity of real valued functions of one variable. Furthermore, the student can solve problems associated with differential and integral calculus of real valued functions of one variable.

Contents:

Vector algebra and analytic geometry. Limit, continuity, differential and integral calculus and applications of real valued functions of one variable. Complex numbers.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 55 h / Group work 22 h.

Target group:

-

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Grossmann, S.I.: Calculus of One Variable; Grossmann, S.I.: Multivariable Calculus, Linear Algebra and Differential Equations (partly); Adams, R.A.: A Complete Course Calculus (partly).

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

031021P: Probability and Mathematical Statistics, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Jukka Kemppainen

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay031021P	Probability and Mathematical Statistics (OPEN UNI)	5.0 op

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Spring semester, periods 4-6

Learning outcomes:

After completing the course the student knows the key concepts of probability and the most important random variables and is able to use them in calculating probabilities and parameters of probability distributions. In addition, the student is able to analyze statistical data by calculating interval and point estimates for the parameters. The student is also able to formulate statistical hypotheses and test them.

Contents:

The key concepts of probability, random variable, parameters of probability distributions, estimation of parameters, hypothesis testing.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 44 h/Exercises 22 h/Self-study 68 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisites are the course 031010P Calculus I and some parts of the course 031011P Calculus II.

Recommended optional programme components:

-

Recommended or required reading:

Milton, J.S., Arnold, J.C. (1992): Introduction to Probability and Statistics.

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Jukka Kemppainen

Working life cooperation:

-

Other information:

-

031022P: Numerical Analysis, 5 op

Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Marko Huhtanen
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Spring semester, periods 4-5

Learning outcomes:

The student recognizes what numerical solution methods can be used to solve some spesific mathematical problems, can perform the required steps in the numerical algorithm and is able to perform the error analysis.

Contents:

Numerical linear algebra. Numerical methods for systems of equations, Basics of the approximation theory. Numerical quadratures. Numerical methods for ordinary and partial differential equations.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 44 h / Group work 22 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the courses Calculus I and II, Differential Equations and Matrix algebra.

Recommended optional programme components:

-

Recommended or required reading:

J. Douglas Faires and Richar L. Burden, Numerical methods; Alfio Quarteroni, Riccardo Sacco, Fausto Saleri, Numerical mathematics

Assessment methods and criteria:

Intermediate exams or a final exam.

Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Marko Huhtanen

Working life cooperation:

-

Other information:

-

477011P: Introduction to Process and Environmental Engineering I, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Sanna Taskila, Aki Sorsa

Opintokohteen kielet: Finnish

Leikkaavuudet:

470219A	Introduction to Process Engineering	3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Implementation during periods 1-2 on the autumn term

Learning outcomes:

The objective of this course is to give insight to the whole perspective of process and environmental engineering and to familiarise the students with the terminology involved. In addition, the objective is also to outline the connections between process and environmental engineering and other fields closely related to them.
After the course, the student can analyse the process and environmental engineering aspects of an industrial process. He/She can, for example, divide the process into unit processes, analyse the process or a chain of processes based on the material balances, identify and evaluate the significance of essential mechanical, chemical and transport phenomena, analyse the control and process design aspects of a process etc. He/She can also evaluate the significance of different aspects of process and environmental engineering to the overall production system when these aspects are further examined in forthcoming courses.

Contents:

The course is divided into the next eight separate themes: 1. Unit processes and material balances. 2. Environmental impacts and their classification. 3. Mechanical phenomena. 4. Momentum, heat and mass transfer phenomena. 5. Chemical reactions and reactors. 6. The possibilities of biological process engineering. 7. Process dynamics and control. 8. Process measurements and measurability.

Mode of delivery:

Group work and contact lectures supporting those

Learning activities and teaching methods:

Assignments (8 altogether) carried out in small groups and contact lectures supporting them (16 hours)

Target group:

Bachelor's degree students in the study fields of process and environmental engineering

Prerequisites and co-requisites:

None

Recommended optional programme components:

The course serves as an introduction to the studies in process and environmental engineering

Recommended or required reading:

The material is provided during the contact lectures and through the course webpages. It is also expected that the students seek material for completing the assignments independently.

Assessment methods and criteria:

The assignments (altogether 8) covering the course themes carried out in small groups.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilises a numerical grading scale 1-5 and fail.

Person responsible:

Dr Aki Sorsa

Working life cooperation:

No

Other information:

The assessment method utilized requires the active attendance to the group work and contact lectures from the beginning of the course

477201A: Material and Energy Balances, 5 op

Voimassaolo: 01.08.2005 - 31.12.2019

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tiina Leiviskä

Opintokohteen kielet: Finnish

Leikkaavuudet:

477221A	Material and Energy Balances	5.0 op
470220A	Fundamentals of Chemical Process Engineering	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish. The course can be completed in English as a book examination.

Timing:

Autumn period 1

Learning outcomes:

The student is able to formulate material and energy balances for a process by taking into account the restrictions set by reaction stoichiometry. The student knows how the created mathematical formulation can be exploited in process consideration.

Contents:

Formulation of material and energy balances by taking into account the effects of chemical reactions.

Mode of delivery:

Lectures and group exercise

Learning activities and teaching methods:

Lectures 40h, group work 10h and self-study 80h

Target group:

Bachelor students in of Process or Environmental Engineering

Prerequisites and co-requisites:

Basics from the course Introduction to Process Engineering

Recommended optional programme components:

-

Recommended or required reading:

Reklaitis, G.V.: Introduction to Material and Energy Balances. John Wiley & Sons, 1983. ISBN 0-471-04131-9.

Assessment methods and criteria:

During the course, there are two intermediate exams and both of them must be passed. Alternatively student can participate in final exam after the course. In addition to this, the students will be making a group exercise, which will be evaluated.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr Tiina Leiviskä

Working life cooperation:

No

Other information:

-

477203A: Process Design, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jani Kangas
Opintokohteen kielet: English
Leikkaavuudet:

480310A	Fundamentals of Process Design	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring period 4

Learning outcomes:

By completing the course the student is able to identify the activities of process design and the know-how needed at different design stages. The student can utilise process synthesis and analysis tools for creating a preliminary process concept and point out the techno-economical performance based on holistic criteria.

Contents:

Acting in process design projects, safety and environmentally conscious process design. Design tasks from conceptual design to plant design, especially the methodology for basic and plant design.

Mode of delivery:

Lectures and design exercises.

Learning activities and teaching methods:

Lectures 30h, group work 50h and self-study 50h

Target group:

Bachelor students

Prerequisites and co-requisites:

Objectives of 477202A Reactor analysis and 477304A Separation processes

Recommended optional programme components:

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Recommended or required reading:

Lecture handout, Seider, W.D., Seider, J.D. and Lewin, D.R. Product and process design principles: Synthesis, analysis and evaluation. John Wiley & Sons, 2004. (Parts) ISBN 0-471-21663-1

Assessment methods and criteria:

Combination of examination and design exercises.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

Scale 0-5

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

-

Other information:

-

477304A: Separation Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Muurinen, Esa Ilmari, Ainassaari, Kaisu Maritta

Opintokohteen kielet: Finnish

Leikkaavuudet:

470323A	Separation Processes	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work.

Language of instruction:

Finnish, can be completed in English as a book examination.

Timing:

Implementation in autumn semester during 2 nd periods. It is recommended to complete the course on the third (Bachelor's) autumn semester.

Learning outcomes:

After the course the student is able to define the position of separation processes based on mass transfer in process and environmental engineering. He/she is capable of solving phase equilibrium problems in multistage separations for binary mixtures. The student is able to explain the phenomena behind the following separation processes: distillation, absorption, stripping, liquid-liquid extraction, supercritical extraction, crystallisation, adsorption, chromatography separation, membrane separations, and reactive separations. He/she recognises the equipment used for these processes and is able to compare the methods to each other with heuristic rules.

Contents:

Separation processes based on mass transfer in process and environmental engineering. Phase equilibrium problems in multistage separations for binary mixtures. Phenomena behind the following separation processes: distillation, absorption, stripping, liquid-liquid extraction, supercritical extraction, crystallisation, adsorption, chromatography separation, membrane separations, and reactive separations. Equipment used for these processes and is able to compare the methods to each other with heuristic rules, etc.

Mode of delivery:

Face-to-face teaching in Finnish. Book examination possible in English.

Learning activities and teaching methods:

Lectures 40 h, exercises 20 h, homework 15 h and self-study 58 h. For foreign students written examination based on given literature and homework.

Target group:

Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:

Courses 477301A Momentum Transfer, 477302A Heat Transfer and 477303A Mass Transfer or 477052A Fluid Mechanics and 477312A Heat and Mass Transfer are recommended beforehand.

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Seader, J.D., Henley, E.J. & Roper, D.K.: Separation Processes Principles. Wiley 2011, 821 p.; Noble, R. D. & Terry, P.A.: Principles of Chemical Separations with Environmental Applications. Cambridge 2004, Cambridge University Press.321 p.

Assessment methods and criteria:

Homework assignments affect the course grade. Examination. The course can be completed with two intermediate exams or one final exam. Homework assignments affect the course grade. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Laboratory manager Dr Esa Muurinen

Working life cooperation:

No

Other information:

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477401A: Thermodynamic Equilibria, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

Leikkaavuudet:

470611A	Metallurgy Processes	7.0 op

ECTS Credits:

5 cr / 135 hours of work

Language of instruction:

Available only in Finnish

Timing:

The course is given in the autumn semester, during period II. It is recommended to complete the course at the 2nd year of Bachelor's studies.

Learning outcomes:

Student is capable of defining chemical equilibria of the systems that are related to industrial processes and understands the relevance of equilibria (and their computational determination) as a part of process analysis, planning and control. Additionally, (s)he can define a meaningful system to be considered in computation thermodynamics; i.e. (s)he can create a computationally solvable problem based on technical problem that in itself is not solvable computationally.

Contents:

Concepts of entalphy (H), entropy (S) and Gibbs free energy (G). The effect of temperature and pressure on H, S and G. Chemical and phase equilibria. Activity and activity coefficient. Calculation of thermodynamic equilibria using equilibrium constant as well as Gibbs free energy minimisation.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Lectures, software exercise as well as other exercises. Available only in Finnish.

Target group:

Students of process and environmental engineering

Prerequisites and co-requisites:

’Basic Principles in Chemistry’ and ’Material and Energy Balances’ as prerequisities

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a education that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Material will be distributed during lectures and exercises.

Assessment methods and criteria:

Students are required to make a portfolio consisting of a learning diary and exercices. Please note that the course is organised only in Finnish.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Eetu-Pekka Heikkinen

Working life cooperation:

No

Other information:

It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun. Course webpage (in Finnish): http://www.oulu.fi/pyomet/477401a.

477501A: Process dynamics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay477501A	Process Control Engineering I	5.0 op
470431A	Process Control Engineering I	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish/English. The main lecturing language is Finnish, but the course can also be taken in English with some special arrangements. Contact the responsible person.

Timing:

Negotiable (for the English version)

Learning outcomes:

After the course, the student understands the basic principles of dynamical behaviour of different processes, can write dynamic mass and energy balances for unit processes, and can solve these with the help of the transfer function approach. He knows also the connection between process control and process dynamics.

Contents:

Basics of process models and dynamics. Dynamic models. Lumped and distributed parameter models. Practical examples of different unit processes such as chemical reactors, distillation columns and heat exchangers. Modelling of large-scale processes.

Mode of delivery:

Negotiable (the course can be taken in English with some special arrangements - contact the responsible person)

Learning activities and teaching methods:

Solving exercise problems; textbook

Target group:

Exchange and other international students (for the English version)

Prerequisites and co-requisites:

Courses Material and Energy Balances, Heat Transfer, Mass Transfer and Control System Analysis recommended beforehand

Recommended optional programme components:

The course forms a basis to the advanced courses in the field of control engineering

Recommended or required reading:

Parts of the textbook used: Luyben, W.L.: Process Modeling, Simulation and Control for Chemical Engineers. McGraw Kogakusha Ltd., Tokyo 1973, 558 pp.

Assessment methods and criteria:

Homework and written/oral test

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Read more about assessment criteria at the University of Oulu webpage.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

-

477502A: Experiment design and analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Aki Sorsa

Opintokohteen kielet: Finnish

Leikkaavuudet:

470432A	Process Control Engineering II	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Implementation in the 4th period on the spring term

Learning outcomes:

After the course, the student knows different experimental design methods and their applicability for different problems. He can also design experiments for multi-variable processes and analyze the results. He can also use some basic means to visualize the results got from experimental data and choose proper tools for experiment design problems.

Contents:

Systematic design of process experiments with matrix techniques (Hadamard, Central Composite Design, Taguchi). Graphical and statistical analysis of experimental data. Correlation, regression and variance analysis. Dynamic data based modelling.

Mode of delivery:

Lectures and extensive exercise work

Learning activities and teaching methods:

Lectures during one period

Target group:

Bachelor's students in process and environmental engineering

Prerequisites and co-requisites:

Course Process Dynamics is recommended beforehand

Recommended optional programme components:

The course forms a basis to the advanced courses in the field of control engineering

Recommended or required reading:

Reading materials. *Additional literature*: Diamond W.J.: Practical Experiment Designs. Lifetime Learning Publications. Belmont, California, 1981. 348 pp.

Assessment methods and criteria:

Examination. It is recommended to take the course also according to the principle of continuous evaluation.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Read more about assessment criteria at the University of Oulu webpage.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

For exchange/international students also the course 477041S Experimental Design is recommended

488010P: Introduction to Process and Environmental Engineering II, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Fabritius, Timo Matti Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

488011P	Introduction to Environmental Engineering	5.0 op
477012P	Introduction to Automation Engineering	5.0 op

ECTS Credits:

5 cr / 135 hours of work

Language of instruction:

Available only in Finnish

Timing:

The course is given in the spring semester, during periods III and IV. It is recommended to complete the course at the 1st spring semester.

Learning outcomes:

Students can examine industrial processes using the methods and perspectives of process and environmental engineering (e.g. material management, phenomenon-based considerations and automation) and they recognize the role of different areas of the process and environmental engineering, when these areas are considered in the forthcoming courses.

Contents:

1. Environmental thinking and industrial ecology. 2. Materials in production processes. 3. Water resources and land use. 4. Municipal and industrial water supply. 5. PI diagrams. 6. Process design. 7. Control and operation of processes.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Group exercises and contact-education (14 h) that supports these exercises. Available only in Finnish.

Target group:

Students of process and environmental engineering

Prerequisites and co-requisites:

None

Recommended optional programme components:

This course is an introduction to the other courses of process and environmental engineering

Recommended or required reading:

Material will be distributed during lectures and via course www-site

Assessment methods and criteria:

Group exercises. Please note that the course is not available in English, but only in Finnish.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Timo Fabritius

Working life cooperation:

No

Other information:

It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun.

488102A: Hydrological Processes, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay488102A Hydrological Processes (OPEN UNI) 5.0 op

480207A Hydraulics and Hydrology 5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish, course can also be completed in English as a self-study/book exam

Timing:

The course unit is given in the autumn semester during period 1. Also the English version of the course is only available in the autumn semester.

Learning outcomes:

After the course, the student understands and can describe the main hydrological processes, water movements and hydraulics phenomenon quantitatively through mathematical methods. The student also understands and quantifies the relation between state and flow with relation to snowmelt, evaporation, infiltration and groundwater flow. After couse student have knowledge also to design pipe and open channel projects.

Contents:

Hydrological cycle, physical properties of water, distribution of water resources, water balance, precipitation, evapotranspiration, soil and ground water, infiltration, runoff, snow hydrology, hydrometry, water quality of rivers and lakes, open channel flow, flow in pipe systems.

Mode of delivery:

Face-face teaching in Finnish, self-study package in English

Learning activities and teaching methods:

For the English self-study package, 4 tutor sessions are arranged during the autumn semester

Target group:

Students in international programs of environmental engineering

Prerequisites and co-requisites:

No

Recommended optional programme components:

The course is a prerequisite for Master level studies

Recommended or required reading:

Physical Hydrology (Dingman SL, 2002, 2nd Edition, ISBN 978-1-57766-561-8), Fluid Mechanics and Hydraulics (Giles, Evett and Liu, 3rd Edition, ISBN 0-07-020509-4)

Assessment methods and criteria:

Both hydrology and hydraulics assignments must be returned and passed with threshold of 50% in order to get final examination. The final grade of the course is weighted average of assignments (80%) and examination (20%)

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Read more about assessment criteria at the University of Oulu webpage.

Person responsible:

University Lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

-

031076P: Differential Equations, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay031076P	Differential Equations (OPEN UNI)	5.0 op
800320A	Differential equations	5.0 op
031017P	Differential Equations	4.0 op

Ei opintojaksokuvauksia.

031075P: Calculus II, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Ilkka Lusikka
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay031075P	Calculus II (OPEN UNI)	5.0 op
031011P	Calculus II	6.0 op

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Spring, period 3

Learning outcomes:

The course gives the basics of theory of series and differential and integral calculus of real and vector valued functions of several variables. After completing the course the student is able to examine the convergence of series and power series of real terms. Furthermore, the student can explain the use of power series e.g. in calculating limits and is able to solve problems related to differential and integral calculus of real and vector valued functions of several variables.

Contents:

Sequences, series, power series and Fourier series of real terms. Differential and integral calculus of real and vector valued functions of several variables.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h / Group work 28 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the course Calculus I.

Recommended optional programme components:

-

Recommended or required reading:

Kreyszig, E.: Advanced Engineering Mathematics; Grossmann, S.I.: Multivariable Calculus, Linear Algebra and Differential Equations.

Assessment methods and criteria:

Intermediate exams or a final exam.

Grading:

Numerical grading scale 1-5.

Person responsible:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

031078P: Matrix Algebra, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Matti Peltola
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay031078P	Matrix Algebra (OPEN UNI)	5.0 op
031019P	Matrix Algebra	3.5 op

Ei opintojaksokuvauksia.

477121A: Particle Technology, 5 op

Voimassaolo: 01.08.2015 - 31.07.2022
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

477120A	Fluid and Particle Engineering	5.0 op
477101A	Fluid and Particle Engineering I	3.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

Finnish

Timing:

Implementation in spring term, period 4

Learning outcomes:

Upon completion of the course, a student should be able to identify the mainline mechanical processes in process industry enhancing the degree of upgrading, as well as recovery operations related to those mechanical main processes. The student is able to identify the equipments related to the mechanical processes and can explain their purpose of use and their operational principles.

Contents:

Granular material and sampling, particle size and particle size distribution, specific surface area, basics in grinding, crushing, sieving and mineral concentration, froth flotation, mineral concentration methods based on density difference, magnetic concentration and other concentration methods, granulation, separation from suspensions

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

The implementation methods of the course are varying. Lectures and exercises max. 48 h. A part of teaching can be replaced by home or group works.

Target group:

: Bachelor students in process and environmental engineering

Prerequisites and co-requisites:

Introduction to process and environmental engineering I (477011P)

Recommended optional programme components:

-

Recommended or required reading:

Lecture materials and other materials that will be announced at the lectures

Assessment methods and criteria:

This course utilizes continuous assessment including lecture diaries and three intermediate exams. Alternatively, the course can also be completed by taking the end exam.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Ari Ämmälä

Working life cooperation:

No

Other information:

-

477122A: Bulk Solids Handling, 5 op

Voimassaolo: 01.08.2015 - 31.07.2023

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477120A	Fluid and Particle Engineering	5.0 op
477102A	Fluid and Particle Technology II	4.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

Finnish

Timing:

Implementation in period 2 (autumn term)

Learning outcomes:

Upon completion of the course, a student should be able to identify auxiliary mechanical unit processes as well as equipments and phenomena related to them. In addition, the student can explain application of unit processes and can describe their operational principles.

Contents:

Liquid and susensions: fluid mechanics, pumping and hydraulic transport, mixing. Gases and aerodispersions: gas dynamics, compression, pneumatic transport. Granular bulk material: properties, storage, mechanical transportation, fluidization.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

The implementation methods of the course vary. Lectures and exercises max. 48 h. A part of teaching can be replaced by home or group works.

Target group:

Bachelor students in process or environmental engineering

Prerequisites and co-requisites:

477101A Particle Technology

Recommended optional programme components:

-

Recommended or required reading:

Lecture materials and other materials that will be announced at the lectures

Assessment methods and criteria:

This course utilizes continuous assessment including lecture diaries and three intermediate exams. Alternatively, the course can also be completed by taking the end exam.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Ari Ämmälä

Working life cooperation:

No

Other information:

-

477222A: Reactor Analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477202A	Reactor Analysis	4.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Period 2 (autumn term)

Learning outcomes:

By completing the course the student is able to explain the determination methods of the reaction rate from experimental data and he/she can illustrate the basics of deterministic modelling. On that basis, the student has skills to analyse the behaviour of ideal reactors and to perform initial reactor selection and sizing.

Contents:

Elementary reactions, kinetics of homogenous reactions. Reaction rate on the basis of experimental data. Modelling of ideal reactors. Yield, selectivity and reactor size. Heuristics for selecting reactor type and operating conditions.

Mode of delivery:

Lectures and small group exercises

Learning activities and teaching methods:

Lectures 40h and self-study 90h

Target group:

Bachelor students in process and environmental engineering, minor subject students

Prerequisites and co-requisites:

Objectives of 477201A Material and Energy Balances and 477401A Thermodynamic Equilibrium

Recommended optional programme components:

-

Recommended or required reading:

Lecture handouts. Levenspiel, O., Chemical Reaction Engineering. John Wiley & Sons, New York, 1972 (Chapters 1-8). Atkins, P.W.: Physical Chemistry, Oxford University Press, 2002. 7th Ed. (Parts) ISBN 0-19-879285-9.

Assessment methods and criteria:

Combination of examination and group exercises

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

No

Other information:

-

477052A: Fluid Mechanics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477301A	Momentum Transfer	3.0 op

ECTS Credits:

5 ECTS / 133 hours of work.

Language of instruction:

Finnish, can be completed in English as a book examination.

Timing:

Implementation in spring semester during 3 rd period. It is recommended to complete the course at the second (Bachelolor's) spring semester. The course will be lectured first time in spring 2016.

Learning outcomes:

After the course the student is able to determine the viscosity of pure substances and mixtures and to estimate the effect of temperature and pressure on viscosity. The student is able to recognise the interactions between a solid body and flowing fluid and to distinguish the forces, their directions and to calculate their magnitudes. The student is able to formulate momentum balance equations and to solve these in order to calculate velocity distribution, flow rate and pressure drop. The student is able to distinguish laminar and turbulent flow regimes from others and is able to use the correct equations according to flow regime. After the course the student is able to design pipelines and other simple flow mechanical process equipment.

Contents:

Viscosity. Mechanism of momentum transfer. Creating and solving differential momentum balances. Friction factor. Macroscopic balances. Flow in pipes and open-channels.

Mode of delivery:

Face-to-face teaching in Finnish. Book examination in English.

Learning activities and teaching methods:

Lectures 45 h, homework 15 h and self-study 73 h. For foreign students written examination based on given literature.

Target group:

Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:

Knowledge of solving differential equations.

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Munson, B.R., Young, D.F. & Okiishi, T.H. Fundamentals of Fluid Mechanics.

Assessment methods and criteria:

This course utilizes continuous assessment. During the course there are 5 intermediate exams. The course can also be completed by final examination. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Eero Tuomaala

Working life cooperation:

No

Other information:

-

477322A: Heat and Mass Transfer, 5 op

Voimassaolo: 01.08.2015 - 31.07.2019

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477323A	Mass and Heat Transfer	5.0 op
477302A	Heat Transfer	3.0 op
477303A	Mass Transfer	3.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish, can be completed in English as a book examination

Timing:

Implementation in autumn semester during 1 st period. It is recommended to complete the course at the third (Bachelor's) autumn semester. The course will be lectured first time in autumn 2016.

Learning outcomes:

After passing the course the student knows what happens when heat is transferred by conduction, convection and radiation. The student can describe energy transfer with differential energy balances connected with momentum balances; In macro scale the student is able to solve practical heat transfer problems by correlating heat transfer coefficients to dimensionless flow and material characteristics; With the help of these transfer coefficients the student is capable of estimating the size of heat transfer equipment, especially heat exchangers and select the most suitable and profitable types; and to Sketch large heat nets and to diminish the costs of the equipments.

The student is able to use the pinch method which optimises the number of heat exchangers and total energy consumption. He/she is also able to apply the exergy principle to make work from thermal energy. With the aid of this principle he/she will be able to divide the costs of the used energy in right proportion based on the processing stage. He/she student is able to explain diffusion as a phenomenon and the factors affecting it. He/she is able to model mass transfer in simple systems by using the theory of Fick. The student is capable of modeling diffusion by differential mass balances. He/she recognises the special features of mass transfer in turbulent systems and the role of different transport phenomena in mass transfer equipment. He/she has rudimentary practical skills applicable to the scale-up of the equipment used for absorption.

Contents:

Mechanism of heat transfer. Creating and solving differential energy balances. Heat transfer coefficient. Macroscopic balances. Selection of a proper type of heat exchanger.Scale-up and design of a heat exchanger.Design of heat exchanger networks using pinch technology.Exergy analysis for the heat flows. Diffusion. The Fick law of diffusion. Mass transfer in simple systems. Differential mass balances. Models of mass transfer in turbulent systems. Interphase mass transfer. Absorption.

Mode of delivery:

Face-to-face teaching in Finnish. Book examination possible in English.

Learning activities and teaching methods:

Lectures 45 h, homework 15 h and self-study 73 h. For foreign students written examination based on given literature.

Target group:

Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:

Knowledge of solving differential equations.

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

(Will be announced later)

Assessment methods and criteria:

This course utilizes continuous assessment. During the course there are 5 intermediate exams. The course can also be completed by final examination. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Kaisu Ainassaari

Working life cooperation:

No

Other information:

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477051A: Automation Engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477601A	Process Automation Systems	4.0 op

ECTS Credits:

5 ECTS /133 h of work

Language of instruction:

Finnish

Timing:

Autumn, period 1

Learning outcomes:

Students learn how to use PI diagrams, field instruments, automation systems and PLCs in design, implementation and commissioning projects. Students can configure and program the basic automation functions in DCSs and PLCs

Contents:

The operational and structural descriptions and concepts of process automation, automation commissioning projects, PI diagrams and field devices, configuration tools for automation functions, logic programming, telecommunication technology in automation, field buses, examples of commercial DCSs, PLCs and field bus systems

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures, demonstrations, configuration and logic programming exercises, excursion to a neighbouring industrial plant

Target group:

B.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

477011P Introduction to process and environmental engineering I and 448010P Introduction to process and environmental engineering II are recommended

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes and handouts, manuals/handbooks

Assessment methods and criteria:

Learning diary or examination

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Jukka Hiltunen and Aki Sorsa

Working life cooperation:

No

Other information:

-

477621A: Control System Analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477602A	Control System Analysis	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish

Timing:

Period 1 (autumn term)

Learning outcomes:

After completing the course the student can describe the process dynamics with mathematical and graphical methods. The student can independently: form linear process models, analyse linear system stability, Bode diagrams, Routh’s stability criterion and the Jury's test, and evaluate the behavior of processes through time and frequency range specifications.

Contents:

Introduction to Matlab. Laplace-transforms. Transfer functions and block diagrams. Dynamical systems. Time and frequency analysis. System stability.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and exercises

Target group:

B.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

The courses 477011P Introduction to process and environmental engineering I, 488010P Introduction to process and environmental engineering II, and 477051A Automation engineering recommended beforehand

Recommended optional programme components:

None

Recommended or required reading:

Materials delivered at the lectures and exercises. Dorf, R. (2010) Modern Control System. 12th ed. Prentice-Hall. 1104 pp. Additional literature: Ogata, K. (2002) Modern Control Engineering. 4th ed. Prentice-Hall. 964 pp., DiStefano, J. (1990) Feedback and Control Systems. 2nd ed. Prentice-Hall. 512 pp.; Ylen; J-P. (1994) Säätötekniikan harjoitustehtäviä. Hakapaino Oy. 252 pp.

Assessment methods and criteria:

Exam and in addition extra points from homeworks

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Lecturer Jukka Hiltunen and university teacher Seppo Honkanen

Working life cooperation:

No

Other information:

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477622A: Control System Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477603A Control System Design 4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish

Timing:

Period 3 (spring term)

Learning outcomes:

After completing the course the students can apply mathematical and graphical methods to the dynamics of process characterisation and control design. The student can form PID controllers for the process, and tune them and evaluate the closed-loop requirements.

Contents:

Laplace-level vs, time level, poles of the system, closed loop and its design specifications, PID control and tuning, Matlab control designer tool, control design in frequency domain

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and exercises

Target group:

B.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

The courses 477011P Introduction to process and environmental engineering I, 488010P Introduction to process and environmental engineering and 477602A Control system analysis recommended beforehand

Recommended optional programme components:

None

Recommended or required reading:

Lecture and exercise handouts. Åström, K & Murray, R. (2009) Feedback Systems, An Introduction for Scientists and Engineers. Princeton University Press, New Jersey, 396 s. Additional literature: Dorf, R (2010) Modern Control Systems. Prentice-Hall, New York, 1104 s., DiStefano, J (1990) Schaum's Outline of Feedback and Control Systems. 2nd ed, McGraw-Hill, 512 s. ja Ylen, J-P (1994) Säätötekniikan harjoitustehtäviä. Hakapaino Oy, 252 s.

Assessment methods and criteria:

Exam

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Professor Enso Ikonen and university teacher Seppo Honkanen

Working life cooperation:

No

Other information:

-

A432227: Module of the Option/Automation Engineering, 61 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

E1

477523S: Simulation, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

477503S	Simulation	3.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish and English

Timing:

Implementation in the 2nd autumn period. Recommended for fourth (1st M.Sc.) year students

Learning outcomes:

Upon completion the student is capable of explaining the concepts and operation principles for both simulators of continuous processes and event-based simulation. The student has skills to construct simulation models in Matlab-Simulink environment and to explain the operation of these models. The student recognizes the key problems of the simulation and is able to choose suitable modeling solutions in process modeling and control. Moreover, the student is able to use key concepts of interactive and distributed simulation. After the course the student is able to search other relevant simulation languages and programming tools

Contents:

Modelling, modular and equation based simulation, dynamic simulation, intelligent methods in simulation, simulation in automation, event handling in continuous simulation, simulation of production processes, distributed simulation, integration with other systems, simulation languages and programming tools

Mode of delivery:

Tuition is implemented mainly as face-to-face teaching

Learning activities and teaching methods:

The amount of guided teaching is 32 h, including lectures (16h), exercises (10h) and seminars (6h). Totally 58 h are allocated for self-study, which consists of three parts: (1) a case study covering several topics applied in a chosen problem, (2) a seminar work concentrating on a single topic, and (3) the final report.

Target group:

M.Sc. students in process and environmental engineering, machine engineering, computer engineering and industrial engineering and management

Prerequisites and co-requisites:

Matlab programming skills are a benefit; see "Recommended optional programme components" below

Recommended optional programme components:

Programming in Matlab course reinforces abilities for the exercises and the case study

Recommended or required reading:

Lecture notes and exercise materials. Material is in Finnish and in English.

Assessment methods and criteria:

The assessment of the course is based on learning diaries, exercises, case study, seminar and the final report. Final exam is an alternative for the final report.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:

D.Sc. (Tech.) Esko Juuso

Working life cooperation:

No

Other information:

-

477524S: Process Optimization, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay477524S	Process Optimization (OPEN UNI)	5.0 op
477504S	Process Optimization	4.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring semester, the 3th period. Recommended for 1st year M.Sc. students.

Learning outcomes:

Student can use and apply standard unconstrained and constrained optimization methods. Student can define and identify optimization problems. Student is able to summarize the role of optimization in process engineering.

Contents:

Basic concepts of optimization. Optimization of unconstrained and constrained functions. Linear programming. Trajectory optimization. Hierarchical optimization. Intelligent methods in optimization. Applications in process engineering.

Mode of delivery:

Face-to-face teaching and exercises as group work

Learning activities and teaching methods:

The amount of guided teaching is 40 hrs. Contact teaching includes, depending on situation, lectures, group work and tutored group work. During self-study time student does independent or group work.

Target group:

M.Sc. students of process and environmental engineering and M.Sc. students interested in process optimization. Exchange and other international students.

Prerequisites and co-requisites:

No prerequisites but basic understanding on numerical methods and process modelling are useful.

Recommended optional programme components:

See prerequisites

Recommended or required reading:

Reading materials. Ray, W.H. & Szekely, J. (1973) Process Optimization with Applications in Metallurgy and Chemical Engineering. John Wiley & Sons.

Assessment methods and criteria:

This course uses continuous assessment that includes solved exercises and lecture exams. Final exam is also possible.

Grading:

The course unit uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

-

477623S: Process Information Systems, 10 op

Voimassaolo: 01.08.2015 - 31.07.2021

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hiltunen, Jukka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

477610S	Process Information Systems	5.0 op
477606S	Fault Diagnosis and Process Performance Analysis	2.0 op

ECTS Credits:

10 ECTS / 266 hours of work

Language of instruction:

Finnish

Timing:

Periods 3-4 (spring term)

Learning outcomes:

After completing the course the student can implement performance-enhancing and maintenance systems, and plan, evaluate and develop also other large scale automation and information systems.

Contents:

Model- and data-based diagnostic methods. Measurement validation. Process performance assessment and follow-up. Application examples. Industrial Internet: Purpose of information systems. Technologies used in wide information systems. Case study analyses.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Seminars. The course is given every second year during two periods.

Target group:

M.Sc. students of process and environmental engineering

Prerequisites and co-requisites:

The course 477051A Automation Engineering recommended beforehand

Recommended optional programme components:

-

Recommended or required reading:

Will be announced later

Assessment methods and criteria:

Learning diary, seminars and exam

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Lecturer Jukka Hiltunen

Working life cooperation:

No

Other information:

-

477607S: Advanced Control and Systems Engineering, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ikonen, Mika Enso-Veitikka

Opintokohteen kielet: Finnish

Leikkaavuudet:

470444S	Advanced Control Methods	6.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish (English if necessary)

Timing:

Period 3 (spring term)

Learning outcomes:

After completing the course the student can design the model based control systems, can formulate and solve state estimation problems, and discover research trends in control and systems engineering

Contents:

1. Model-based control: as DMC, QDMC; GPC. 2. State estimations: as Kalman filtering and particle filters. 3. Active research directions (elected annually)

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and demonstration exercises

Target group:

M.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

The courses 477602A Control system analysis, 477603A Control system design, 4776xxS Control system methods, 477605S Digital control theory recommended beforehand

Recommended optional programme components:

None

Recommended or required reading:

Materials distirbuted during the contact teaching and through the course web pages

Assessment methods and criteria:

Exam and homework

Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1.5 or fail

Person responsible:

Professor Enso Ikonen

Working life cooperation:

No

Other information:

-

477525S: Computational intelligence in automation, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477505S	Fuzzy-neuromethods in Process Automation	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish and English

Timing:

Implementation in the autumn term, on hte 2nd period. Recommended for fourth year students (first M.Sc. year)

Learning outcomes:

After the course the student is capable of explaining the concepts of intelligent systems and operation principles of fuzzy set systems, neural networks, neuro-fuzzy systems and evolutionary computation. The student has skills to construct and tune fuzzy models in Matlab-Simulink environment and to explain the operation of these models. The student is able to explain in an integrating way the principle concepts of neural computing and construct neural network models in Matlab-Simulink environment. The student recognizes the key problems of the data-driven modelling and is able to choose suitable solutions which ensure generalization. The student is able to explain the operation principles of genetic algorithms and to use them in tuning of fuzzy set systems and neural network models. Moreover, the student is able to describe alternative solutions for dynamic models, hyperplane methods and hybrid solutions. The student can explain the key concepts of cellular automata and evolutionary computation. After the course the student is able to search other relevant programming tools.

Contents:

Fuzzy logic and fuzzy set systems, fuzzy calculus, fuzzy modeling and control, neural computation, learning algorithms, neuro-fuzzy methods, linguistic equations, evolutionary computation, hyperplane methods, cellular automata, intelligent diagnostics and decision making, adaptive intelligent systems, hybrid systems.

Mode of delivery:

Tuition is implemented mainly as face-to-face teaching.

Learning activities and teaching methods:

The amount of guided teaching is 32 hrs, including lectures (16), exercises (10) and seminars 6). Totally 58 hrs are allocated for self-study, which consists of three parts: (1) a case study covering several topics applied in a chosen problem, (2) a seminar work concentrating on a single topic, and (3) the final report.

Target group:

M.Sc. students in process and environmental engineering, machine engineering, computer engineering and industrial engineering and management.

Prerequisites and co-requisites:

No specific prerequisites, but skills for simulation, and programming in Matlab are a benefit. See "Recommended optional programme components" below.

Recommended optional programme components:

Courses Simulation, and Programming in Matlab reinforce abilities for the exercises and the case study

Recommended or required reading:

Lecture notes and exercise materials. Material is in Finnish and in English.

Assessment methods and criteria:

The assessment of the course is based on the exercises, case study, seminar and the final report. Final exam is an alternative for the final report.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

D.Sc. (Tech.) Esko Juuso

Working life cooperation:

No

Other information:

-

Choose 5 courses

031080A: Signal Analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Kotila, Vesa Iisakki

Opintokohteen kielet: Finnish

Leikkaavuudet:

031050A	Signal Analysis	4.0 op

Ei opintojaksokuvauksia.

477506S: Modelling and Control of Biotechnical Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: English

Leikkaavuudet:

480452S	Bioprocess Modelling and Control	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Implementation in the 1st period (autumn term)

Learning outcomes:

After the course, the student can model kinetics and dynamics of bio-technical processes (mainly fermentation) starting from the process phenomena and mass balance models. He also understands the limitations of different approaches and the modelling assumptions. He also has preliminary skills to write models in Matlab/Simulink environment.

Contents:

Bioreactors: models, kinetics and transfer phenomena. Models: different modelling approaches with examples. Control of fermentation processes.

Mode of delivery:

Contact lectures, individual work and home tests (one per week)

Learning activities and teaching methods:

The course is given within the period of five weeks. Laboratory exercises include computational exercises and writing the report.

Target group:

Master's students in Process and Environmental Engineering /Automation Technology

Prerequisites and co-requisites:

Course Process Control Engineering I or respective recommended beforehand

Recommended optional programme components:

-

Recommended or required reading:

Lecture material*s.*
Additional literature: Schügerl, B. (ed.): Bioreaction Engineering. Springer Verlag, 2000. pp. 21-43.; Sonnleitner, B.: Instrumentation of Biotechnical. In: Advances in Biochemical Engineering 66. Springer 2000; Jeongseok, L. et al.: Control of Fed-batch Fermentations. Biotechnology Advances 17 (1999) 29-4817 (1999) 29-48; Rani, K.Y. & Rao, V.S.R.: Control of Fermenters - a Review. Bioprocess Engineering 21 (1999) 77-8821 (1999) 77-88
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Assessment methods and criteria:

Grade given is based on home tests and exercise report; ratio is 4/1. Final examination is also possible.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä, Dr Aki Sorsa

Working life cooperation:

No

Other information:

-

477507S: Automation in Pulp and Paper Industry, 5 op

Voimassaolo: 01.08.2005 - 31.07.2021

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: English

Leikkaavuudet:

470338S	Process Control in Pulp and Paper Industry	3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

No set schedule. Contact the responsible person.

Learning outcomes:

After the course, the student knows the management and control problems in pulp and paper industry and can choose between the main means to solve them. He knows also the need and practice of special measurements on this area. He can apply the skills of earlier studies in analysing the control of separate processes and larger process lines and can estimate technical and economic effects of automation in pulp and paper industry.

Contents:

Control systems and methods, special measurements, automation in pulp industry (fibres, chemicals, mechanical pulping, paper machines, mill-wide automation), process analysis, modelling, and simulation. Application of intelligent methods in paper industry.

Mode of delivery:

Individual work (self-study/group work); no lectures given

Learning activities and teaching methods:

The course includes a literature review of a given topic done in groups of 2-3 students and a written test from the book given below. The course can be taken any time regardless of teaching periods.

Target group:

Master's students in study programmes Process or Environmental Engineering /study option Automation Technology. Exchange and other international students of the field.

Prerequisites and co-requisites:

Course Pulp and Paper Technology recommended beforehand

Recommended optional programme components:

-

Recommended or required reading:

Leiviskä, K.: Process Control. Book 14. Papermaking Science and Technology Series. Fapet Oy 1999.

Assessment methods and criteria:

Book examination, literature report.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

-

477508S: Automation in Metallurgical Industry, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Implementation in the 4th period (spring term)

Learning outcomes:

After the course, the student knows the management and control problems in metallurgical industry and can choose between the main modelling and control methods to solve them. He can apply the skills of earlier studies in analysing the control of separate processes and larger process lines and can estimate technical and economic effects of automation in metallurgical industry.

Contents:

Modelling and control examples of steel production processes: coking, sintering, blast furnace, steel converter, continuous casting, and rolling mill. Model solutions by special-purpose simulators. Also some special measurements are introduced.

Mode of delivery:

Lectures, practical group work using simulators

Learning activities and teaching methods:

Lectures during one period

Target group:

Master's students in the study programmes of Process or Environmental Engineering/study option Automation Technology. Exchange and other international students.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes in English. Everyone does his/her material during the course in the form of lecture diary that is returned and evaluated at the end. Group work uses the simulator in the Internet.

Assessment methods and criteria:

Continuous evaluation: lectures, lecture diaries, test, and practical work using simulation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

-

477625S: Power Plant Automation, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477611S	Power Plant Automation	2.0 op
477612S	Power Plant Control	3.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish

Timing:

Period 4 (spring term)

Learning outcomes:

The student has a full understanding of the role of the power plants in energy market and the importance of different energy sources. The student will understand the structure of different power plants, the main components and can explain their behavior and operation. The role and manner of measurements will be clarified. Furthermore, the student will understand the main principles in modelling energy systems. The student will fully understand the static and dynamic behaviour of the power plants and the sub processes. The student will understand the role of control in power plant operation and can describe the main principles and structures of control systems. The student can implement the theoretical knowledge gained in power plant automation courses into practice and has deepened his/her understanding in the subject. The student knows the principles of power plant operation in different situations (start-ups and shut-downs, load changes).

Contents:

Introduction to energy market and consumption. Description of different types of power plants and the main components and their operation. Fundamentals of industrial measurements, sensors, emissions and industrial actuators. Static and dynamic modelling of power plants. . The control principles and the main control loops. Comparison of different control solutions. 3 x 4h simulation exercises in small groups (2-4 persons) with a MetsoDNA power plant simulator.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures, exercises and industrial visit. Final exam.

Target group:

M.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

No

Recommended optional programme components:

The course is followed by course 477612S Power Plant Control

Recommended or required reading:

Lecture hand-out and Joronen,T., Kovács J. & Majanne Y. (2007) Voimalaitosautomaatio. Suomen automaatioseura Oy. 276 pp.

Assessment methods and criteria:

Exam

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Docent Jenö Kovács, Ph. D. student Laura Niva and lecturer Tero Hietanen (OAMK, Oulu University of Applied Sciences)

Working life cooperation:

No

Other information:

-

477713S: Automation in Mineral Processing, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: Finnish

Leikkaavuudet:

477510S	Automation in Mineral Processing	5.0 op
477724S	Numerical Mine Modelling	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Implementation in the 4th period (spring term)

Learning outcomes:

The target is to give the students the skills to understand and develop models for minerals processing and apply these models in process monitoring and control.

Contents:

Models for processes like crushing, grinding, flotation, leaching, separation etc. Examples how to use these models in process control and what kind of benefits can be drawn from their use.

Mode of delivery:

Lectures and demonstrations

Learning activities and teaching methods:

Lectures during one period

Target group:

Master's students in process and environmental engineering. Exchange students.

Prerequisites and co-requisites:

Basic knowledge in minerals processing and control engineering

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes in English

Assessment methods and criteria:

Continuous evaluation: lectures and test

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

-

H432228: Module of the Option/Bioproducts and Bioprocess Engineering, 60 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional

A432228: Module of the Option/Bioproducts and Bioprocess Engineering, Bioproduct Tehcnology, 31 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

477123S: Chemical processing of biomasses, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English
Leikkaavuudet:

477104S	Chemical Pulping	3.0 op

ECTS Credits:

5 ECTS /133 h of work

Language of instruction:

English

Timing:

Implementation in autumn period 1

Learning outcomes:

Upon completion of the course, a student should be able to explain the value chain of chemical processing of renewable lignocellulosic raw materials to pulp and different end-products. A student is able to indentify lignocellulosic raw material sources, their properties, their main components and utilization potential of components. The student also indentifies the unit operations of chemical pulping processes, can explain their operational principles and their objectives in the process and their role in end product properties. Besides cellulose fibre production, the student identifies biorefining concepts of chemical pulp components (cellulose, hemicelluloses, lignin and extractives) into high value products; cellulose derivatives, special fibres, nanofibrillar and micronized celluloses, and green chemicals.

Contents:

Lignocellulosic raw materials, fundamentals of chemical pulping, recovering of chemicals in kraft pulping, bleaching of pulp. High value biomass products by biorefining (e.g. nanocelluloses and soluble celluloses).

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

The implementation methods of the course vary. Lectures and exercises 32 h, web learning 64 h, and self-study 37 h. A part of teaching can be replaced by group works or home works.

Target group:

Students interested in bioeconomy

Prerequisites and co-requisites:

488052A Introduction to Bioproduct and Bioprocess Engineering is recommended.

Recommended optional programme components:

-

Recommended or required reading:

Book series: Fapet Oy. Papermaking Science and Technology, book 6: Chemical pulping Part 1 and Part 2, book 20: Biorefining of Forest Resources. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:

This course utilizes continuous assessment including lecture diarys, self tests during web learning and three intermediate exams. Alternatively, the course can also be completed by taking the end exam. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Ari Ämmälä

Working life cooperation:

No

Other information:

-

477124S: Mechanical processing of biomasses, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477105S	Mechanical Pulping	3.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

English

Timing:

Implementation in autumn period 2

Learning outcomes:

Upon completion of the course, a student should be able to explain the value chain of mechanical and chemimechmical processing of renewable lignocellulosic raw materials. Upon completion of the course, a student should be able to identify the unit operations of mechanical and chemi-mechanical pulping process and can explain their operational principles. The student can evaluate the raw material properties and importance of different unit processes on the quality of the end products. In addition, the student can compare fibre properties of different mechanical and chemi-mechanical pulps and wood powders and can explain their effects on the quality of the end product. Student can explain production principle of engineered wood, biocomposites and pelletizing.

Contents:

Processing of wood, mechanical fibres, wood powders: raw material properties, mechanical and chemimechanical defibering, screening, bleaching, biomass micronization and pulverization, the production of engineered wood, wood-plastic composites and pellets. End product properties.

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

The implementation methods of the course vary. Lectures and exercises 32 h, web learning 64 h, and self-study 37 h. A part of teaching can be replaced by group works or home works.

Target group:

Students interested in bioeconomy

Prerequisites and co-requisites:

488052A Introduction to Bioproduct and Bioprocess Engineering is recommended

Recommended optional programme components:

-

Recommended or required reading:

Book series: Fapet Oy. Papermaking Science and Technology, book 5: Mechanical Pulping. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:

This course utilizes continuous assessment including lecture diarys, self tests during web learning and three intermediate exams. Alternatively, the course can also be completed by taking the end exam. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

This course utilizes continuous assessment including lecture diarys, self tests during web learning and three intermediate exams. Alternatively, the course can also be completed by taking the end exam.

Person responsible:

Ari Ämmälä

Working life cooperation:

No

Other information:

-

477125S: Recycling of bioproducts, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477128S	Circular Bioeconomy	5.0 op
477106S	Recycled Fiber Processes	3.0 op
477105S	Mechanical Pulping	3.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

English

Timing:

Implementation in the spring period 3

Learning outcomes:

Upon completion of the course, a student should be able to recognize the incentives for the recycling of bioproducts and waste streams from bioproduct industry. Student identifies collection and recovering systems, recovered material properties and their impact on processing, principles unit processes and processing with respect to final product requirement. A student should be able to identify the unit operations of required processing and explain their key operational principles and also the function of the most important chemicals. A student can also perceive the importance of life-cycle assessment and recyclability properties design in both R&D and production stages of bioproducts, including the significance of bioenergy production as a part of bioproduct recycling.

Contents:

Reuse, recycling and energy utilization of bioproduct and side streams of bioproduct industry in accordance with waste hierarchy. Analysis procedures to assess raw material utilization potential. Process concepts and unit processes in recycling and reusing of bioproducts including wood products, paper and board products, biocomposites and side streams. The utilization and final disposal of residuals from bioenergy production.

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

The implementation methods of the course vary. Lectures and exercises 32 h, web learning 64 h, and self-study 37 h. A part of teaching can be replaced by group works or home works.

Target group:

Students interested in bioeconomy

Prerequisites and co-requisites:

488052A Introduction to Bioproduct and Bioprocess Engineering is recommended

Recommended optional programme components:

-

Recommended or required reading:

Book series: Fapet Oy. Papermaking Science and Technology, book 7: Recycled Fiber and Deinking. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:

This course utilizes continuous assessment including lecture diarys, self tests during web learning and three intermediate exams. Alternatively, the course can also be completed by taking the end exam. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Ari Ämmälä

Working life cooperation:

No

Other information:

-

477126S: Manufacturing of fibre products, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477107S	Paper Manufacture	3.0 op
477106S	Recycled Fiber Processes	3.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

Finnish. Possible to complete also in English as a book examination.

Timing:

Implementation in spring period 4

Learning outcomes:

Upon completion of the course, a student should be able to identify the unit operations paper and board manufacturing and can explain their purpose of use. The student can name the most important chemicals, fillers and coating pigments and can explain their importance in paper and board making. The student can present the essential properties of papermaking fibres, the structure and properties of paper and board, as well as different paper and board grades. The student knows the fundamentals of printing technology and indentifies paper properties essential for printing.

Contents:

Properties of fibers, web forming, chemicals in paper manufacture, coating process, structure and properties of paper, paper processing, paper grades, and fundamentals of printing technology.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and case studies, excursion to paper mills and printing laboratory.

Target group:

Students interested in bioeconomy

Prerequisites and co-requisites:

488052A Introduction to Bioproduct and Bioprocess Engineering is recommended

Recommended optional programme components:

-

Recommended or required reading:

Book series: Fapet Oy. Papermaking Science and Technology, books 8-11, and 13. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:

Exam and case studies. Book exam in English is possible for foreign students. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Timo Jortama, Ari Ämmälä

Working life cooperation:

No

Other information:

-

477127S: Research training of bioproduct technology, 10 op

Voimassaolo: 01.08.2015 - 31.07.2021

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477133S	Research training of bio and circular economy	5.0 op
477131S	Characterisation of biobased materials	5.0 op
477130S	Research training of bio and circular economy	10.0 op
477113S	Research Training of Pulp and Paper Technology	10.0 op

ECTS Credits:

10 ECTS / 266 hours of work

Language of instruction:

English. Possible to complete also in Finnish.

Timing:

Implementation during autumn periods 1-2

Learning outcomes:

Upon completion of the course, a student can design, carry out and report an experimental research project.

Contents:

Using of literature, making focused experimental plans, the execution of laboratory and/or pilot scale experiments, data processing and reporting, and writing a scientific paper.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Research project is executed under a supervision of research scientists. A student reports project results in the form of scientific paper and oral presentation.

Target group:

Students interested in bioeconomy

Prerequisites and co-requisites:

Studies in the field of bioproduct technology are recommended

Recommended optional programme components:

-

Recommended or required reading:

Materials given by a supervisor

Assessment methods and criteria:

Evaluaton of student's working skills, evaluation of research report, and evaluation of oral presentation. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Ari Ämmälä

Working life cooperation:

Yes. During the course a student works as a member of the research group. The research work consists of hands-on working with laboratory equipment and analysis devices.

Other information:

-

A432229: Module of the Option/Bioproducts and Bioprocess Engineering, Bioprocess Engineering, 59 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

488321S: Bioreactor technology, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488304S	Bioreactor Technology	6.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course is held in autumn semester during period 2. It is recommended to complete the course in the 4th (1st Master's) year.

Learning outcomes:

After completing this course, the student will be able to verbally describe the most common equipment, materials and methods related to biotechnological processes, microbial growth and cultivation and sterilization. The student will be able to apply different mathematical formulas for biocatalysis and for the bioreactor performance and use those to plan and analyze bioprocesses. The student will also be able to produce, analyze and interpret data from bioprocesses.

Contents:

Biotechnological process: General process schemes, batch, fed-batch and continuous processes, biocatalysts and raw materials. Reactor design and instrumentation. Sterilization: kinetics of heat inactivation and practical implementation of sterilization methods. Mathematical description and quantification of the function of biocatalysts. Monod and Micahelis-Menten models, reaction rates and their determination. The lag phase of growth, cellular maintenance, cell death. Kinetics of product and by-product formation. Kinetics of oxygen and heat transfer. Oxygen and heat balances: significance and calculations. Power consumption. Scale-up and scale-down.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures 50 h / exercises 8 h / homework 16 h / self-study 59 h.

Target group:

Master students in bioprocess engineering. Master students in process engineering, environmental engineering and biochemistry with required prerequisites.

Prerequisites and co-requisites:

The previous bachelor level courses in Process or Environmental Engineering (especially 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering) or respective knowledge.

Recommended optional programme components:

-

Recommended or required reading:

Lectures: Lecture hand outs; Doran, P. M. Bioprocess engineering principles. Academic Press. London, 2010. Supplementary material: Villadsen J., Nielsen J., Liden G. Bioreactor engineering principles. Springer Verlag, 2011.

Assessment methods and criteria:

Lectures, exercises, final exam, homework. Grade will be composed of final exam, exercises and homework.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Johanna Panula-Perälä

Working life cooperation:

No

Other information:

-

488305S: Advanced Course for Biotechnology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Sanna Taskila

Opintokohteen kielet: English

Leikkaavuudet:

480450S	Bioprocesses III	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course is held in spring semester during period 3. It is recommended to complete the course in the 4th (1st Master's) year.

Learning outcomes:

After completing this course, the student will be able to describe the most important techniques - both up- and downstream - in biotechnological production of proteins and metabolites.

Contents:

Microbial homologous and heterologous protein production. Physiological and process related items in the production of selected microbial metabolites. Principles and practices in metabolic engineering. Methods for process intensification. Scale-up of bioprocesses. Unit operations in product recovery and purification.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures 36 h / homework 48 h / self-study 49 h.

Target group:

Master students in bioprocess engineering. Master students in process engineering, environmantal engineering and biochemistry with required prerequisites.

Prerequisites and co-requisites:

Courses 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering and 488304S Bioreactor technology, or respective knowledge.

Recommended optional programme components:

-

Recommended or required reading:

Will be announced at the lectures.

Assessment methods and criteria:

Lectures and final examination, exercises and the report. Grade will be composed of homework exercises and reports or final examination. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr. Sanna Taskila

Working life cooperation:

No

Other information:

-

488311S: Industrial Microbiology, 5 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Sanna Taskila

Opintokohteen kielet: English

Leikkaavuudet:

488310S Laboratory Course in Microbiology 2.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course is held as intensive course in autumn semester during period 2

Learning outcomes:

After completing this course, the student will be able to operate in a microbiological laboratory. The student will be able to handle and cultivate microbes, follow the growth of microbes, and to apply these methods to different microbes. Student will be able to write a laboratory diary.
The student will be able to plan and conduct bench-scale research on biotechnical processes using aseptic techniques, and to evaluate and report the results of her/his research. The student will learn to apply microbes for the production of relevant biochemicals, to conduct analyses and mathematically examine the performance of studied production systems, to evaluate the challenges in up-scaling of the system, and to compare the results of research to existing literature.

Contents:

The topic of the course is related to current topics in biotechnology. The work will include laboratory exercises in the area of biocatalysis under supervision of researchers and a written final report including results of laboratory work. An industry excursion related to the course topic is arranged in Oulu area when possible.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 2 h/ laboratory exercises 70 h/ written report 35 h / self-study 26 h.

Target group:

Master's students of bioprocess engineering.

Prerequisites and co-requisites:

Courses 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering, 488304S Bioreactor technology, or respective knowledge.

Recommended optional programme components:

-

Recommended or required reading:

Working instructions; current publications and textbooks etc. on microbiology, biotechnology and environmental engineering.

Assessment methods and criteria:

Grade will be composed of supervised practical laboratory exercises, written report, literature search, and seminar. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr. Sanna Taskila, University teacher Johanna Panula-Perälä

Working life cooperation:

No

Other information:

-

488322S: Bioprocess Engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

488307S	Bioprocess Engineering	7.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course is given in spring semester during period 4. It is recommended to complete the course in the 4th year.

Learning outcomes:

In this course students will learn key methods of microbial production (e.g. fermentation, protein production and purification). Practice in research project planning, in different methods for biotechnology, and in report writing and seminar presentation will train the student for conducting a scientific research project.
After completing this course, the student will be able, under supervision, to prepare a research plan for his/her practical laboratory training research project. The student will be able to apply different biotechnological methods used in the recombinant protein production, in fermentation processes and in protein purification. He/she will be able to analyze the research results and to present them both in written and oral form.

Contents:

A student will be personally supervised by researchers during three weeks laboratory practicum. In the end of the practicum, the student will provide an extended written report, including a literature study and the practical results. The student will also practice a scientific seminar presentation. Subjects are changed annually.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 2 h / Laboratory exercises 70 h / written report 30 h / literature research and seminar 30 h

Target group:

Master students in the study option bioprocess engineering

Prerequisites and co-requisites:

Courses 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering, 488311S Industrial microbiology, 488304S Bioreactor technology, 488305S Advanced Course for Biotechnology, or respective knowledge

Recommended optional programme components:

-

Recommended or required reading:

Working instructions; current publications and textbooks on bioprocess engineering, microbiology and biotechnology depending on the annual subject. Other material announced at the lectures.

Assessment methods and criteria:

Grade will be composed of supervised practical laboratory exercises, written report, literature search, and seminar. Course is primarily meant for the students of bioprocess engineering study option.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Johanna Panula-Perälä

Working life cooperation:

No

Other information:

Detailed schedule of the course is informed in the starting lecture

740148P: Biomolecules, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Faculty of Biochemistry and Molecular Medicine

Arvostelu: 1 - 5, pass, fail

Opettajat: Tuomo Glumoff

Opintokohteen kielet: English

Leikkaavuudet:

ay740157P	Basic biochemistry 1: Biomolecules (OPEN UNI)	4.0 op
ay740152P	Basic biochemistry 1: Biomolecules (OPEN UNI)	5.0 op
740143P	Biomolecules for Biochemists	8.0 op
740147P	Biomolecules for Bioscientists	8.0 op

ECTS Credits:

5 credits

Language of instruction:

English

Timing:

autumn-spring

Learning outcomes:

Upon successful completion students are able to:

- tell the composition, structure and function of the major groups of biomolecules in cells; nucleic acids, proteins, carbohydrates and lipds and describe the forces that modulate their function.
- apply information in the right context and evaluate it critically

Contents:

This module provides an overview of biochemistry, outlining the forces involved in biomolecule structure and the chemical structures and properties of polynucleic acids, proteins, carbohydrates and lipids. There will also be an introduction to prebiotic evolution and a student debate on this subject. The module is arranged into lectures, workshops, a student debate. All of the exercises are in English. Both a final examination and continuous assessment will count towards the final mark and attendance of some parts is compulsory.

Mode of delivery:

Face to face teaching

Learning activities and teaching methods:

30 h lectures, plus exercises

Target group:

Minor subject students

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Mathews, van Holde & Ahern: Biochemistry, (3rd edition) , published by Addison Wesley Longman, Inc. or equivalent

Assessment methods and criteria:

Continuous assessment, final examination
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5/fail

Person responsible:

Tuomo Glumoff

Working life cooperation:

No

Other information:

This module is the same as Biomolecules for Biochemists except that it contains no practical component. Location of instruction: Linnanmaa campus

740149P: Metabolism I, 4 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Faculty of Biochemistry and Molecular Medicine

Arvostelu: 1 - 5, pass, fail

Opettajat: Tuomo Glumoff

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay740158P	Basic biochemistry 3: Metabolis (OPEN UNI)	4.0 op
ay740154P	Basic biochemistry 3: Metabolis (OPEN UNI)	3.0 op
740146P	Metabolism I	6.0 op

ECTS Credits:

4 credits

Language of instruction:

Finnish

Timing:

spring

Learning outcomes:

Students will be able to explain the main principles of how the metabolism is made up, will get a detailed picture of the energy metabolism, and will be able to organize part of the wholeness of metabolism, particularly how energy metabolism is networked to the synthesis and degradation of biomolecules.

Contents:

On this course the central concepts and mechanisms of metabolism, its regulation and the integration of metabolic pathways will be introduced, like anabolism and catabolism, linking of different pathways, and metabolic regulation. Especially the energy metabolism will be studied, concerning carbohydrates, lipids and the respiratory chain. Combined with the course Metabolism II the students will get a good overview on the principles of metabolism, metabolic integration and the methods to study metabolism.

Mode of delivery:

Face to face teaching

Learning activities and teaching methods:

Lectures (28 h), problem-based exercises (workshops) 6 h and final exam.

Target group:

Minor subject students

Prerequisites and co-requisites:

Biomolecules for Biochemists or Biomolecules for Bioscientists or Biomolecules

Recommended optional programme components:

-

Recommended or required reading:

-

Assessment methods and criteria:

Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5/fail. Problem-based exercises and a final exam will count towards the final grade.

Person responsible:

Tuomo Glumoff

Working life cooperation:

-

Other information:

This module is the same as Metabolism I (740146P), except that it contains no laboratory component.
Location of instruction: Linnanmaa

477506S: Modelling and Control of Biotechnical Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: English

Leikkaavuudet:

480452S	Bioprocess Modelling and Control	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Implementation in the 1st period (autumn term)

Learning outcomes:

After the course, the student can model kinetics and dynamics of bio-technical processes (mainly fermentation) starting from the process phenomena and mass balance models. He also understands the limitations of different approaches and the modelling assumptions. He also has preliminary skills to write models in Matlab/Simulink environment.

Contents:

Bioreactors: models, kinetics and transfer phenomena. Models: different modelling approaches with examples. Control of fermentation processes.

Mode of delivery:

Contact lectures, individual work and home tests (one per week)

Learning activities and teaching methods:

The course is given within the period of five weeks. Laboratory exercises include computational exercises and writing the report.

Target group:

Master’s students in Process and Environmental Engineering /Automation Technology

Prerequisites and co-requisites:

Course Process Control Engineering I or respective recommended beforehand

Recommended optional programme components:

-

Recommended or required reading:

Lecture material*s.*
Additional literature: Schügerl, B. (ed.): Bioreaction Engineering. Springer Verlag, 2000. pp. 21-43.; Sonnleitner, B.: Instrumentation of Biotechnical. In: Advances in Biochemical Engineering 66. Springer 2000; Jeongseok, L. et al.: Control of Fed-batch Fermentations. Biotechnology Advances 17 (1999) 29-4817 (1999) 29-48; Rani, K.Y. & Rao, V.S.R.: Control of Fermenters - a Review. Bioprocess Engineering 21 (1999) 77-8821 (1999) 77-88
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Assessment methods and criteria:

Grade given is based on home tests and exercise report; ratio is 4/1. Final examination is also possible.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä, Dr Aki Sorsa

Working life cooperation:

No

Other information:

-

477204S: Chemical Engineering Thermodynamics, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Period 1 (autumn term)

Learning outcomes:

By completing the course the student understands classical thermodynamics from a chemical engineering viewpoint. Especially she/he can explain the pVT behaviour of pure substances and understands the thermodynamic properties of mixtures. The student can classify the thermodynamic models describing, for example, liquid mixtures or electrolytes. The student can select appropriate models for gas, vapour and liquid phases. In addition, the student can solve process models, phase equilibrium and chemical reaction equilibrium problems, and more generally, is able to evaluate chemical processes using thermodynamic analysis tools.

Contents:

Mass and energy balances, pVT behaviour of pure substances, thermodynamic properties of fluids, thermodynamics of electrolytes, chemical reaction equilibrium, vapour/liquid equilibrium, calculation of thermodynamical state functions, thermodynamic analysis of processes.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 34h and self-study 99h

Target group:

Students in the study options Process Design and Chemical Engineering

Prerequisites and co-requisites:

Thermodynamic equilibria

Recommended optional programme components:

Part of the Process Design Module

Recommended or required reading:

Lecture handout. Material given during the lectures. Additional literature, Smith, J.M. & Van Ness, H.C. Introduction to Chemical Engineering Thermodynamics. McGraw-Hill, 1987.

Assessment methods and criteria:

Combination of examinations and exercises
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Juha Tanskanen

Working life cooperation:

No

Other information:

-

477308S: Multicomponent Mass Transfer, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ainassaari, Kaisu Maritta, Muurinen, Esa Ilmari

Opintokohteen kielet: Finnish

Leikkaavuudet:

470302S	Multicomponent Separation	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish, can be completed in English as a book examination

Timing:

Implementation in spring semester during 4 th period. It is recommended to complete the course at the fourth (first Master's) spring semester

Learning outcomes:

Upon completing the required course work the student is able to formulate matrix equations describing mass transfer in multicomponent systems using the theory of Maxwell-Stefan and the laws of Fick for laminar and turbulent systems. He/she is also able to define bootstrap relations to bind the general equations to the physical situation of the problem, and is capable of applying the methods to estimate diffusion and mass transfer coefficients. In addition, he/she is able to describe the theories for mass transfer through phase interface, to calculate the multicomponent phase equilibrium formed by mass transfer across fluid interphase with equations of state and activity coefficient correlations, and to explain the experimental methods to measure vapour-liquid equilibrium and the methods to estimate the validity of measured values. After completing the course the student is capable of applying models of mass transfer and phase equilibrium to model and design multicomponent processes (e.g. distillation and condensation) based on diffusion.

Contents:

Maxwell-Stefan equations. Fick's law.Estimation of diffusion coefficients.Multicomponent systems. Mass transfer coefficients. Film theory. Mass transfer models for dynamic systems. Mass transfer in turbulent flows. Simultaneous mass and heat transfer. Vapour-liquid equilibrium and experimental determination. Mass transfer models in multicomponent distillation. Condensation of vapour mixtures.

Mode of delivery:

Face-to-face teaching in Finnish (book examination in English)

Learning activities and teaching methods:

Lectures 30 h, exercises 8 h, simulation exercise 15 h and self-study 80 h. For foreign students: a written examination based on given literature and simulation exercise

Target group:

Master's degree students of process and environmental engineering

Prerequisites and co-requisites:

Courses 477303A Mass Transfer or 477312A Heat and Mass Transfer, 477304A Separation Processes and 031019P Matrix Algebra are recommended beforehand

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Taylor, R. & Krishna, R.: Multicomponent Mass Transfer, John Wiley & Sons, 1993, 579 p.; Henley, E.J. &Seader, J.D.: Equilibrium-stage Separation Operations in Chemical Engineering, John Wiley & Sons, 1982, 742 p.
Additional literature: Walas, S.M.: Phase Equilibria in Chemical Engineering, Butterworth Publishers, 1985, 671 pp.

Assessment methods and criteria:

Examination or a learning diary and a simulation exercise. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Laboratory manager Dr Esa Muurinen

Working life cooperation:

No

Other information:

-

477306S: Non-ideal Reactors, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

Leikkaavuudet:

470222A	Reactor Analysis and Design II	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in the autumn semester during the 2nd period. It is recommended to complete the course at the fourth (1st Master's) autumn semester.

Learning outcomes:

After completing the course the student can analyse the effect of non-ideal mixing conditions on the behaviour of a reactor. He/she is capable of explaining the mechanisms of heterogeneous reactions, especially with methods that are used to analyse the effect of mass and heat transfer on the observed kinetics of heterogeneous reactions. The student has rudimentary skills to conduct demanding reactor analysis and to design heterogeneous reactors.

Contents:

Mixing models of a flowing material. Residence time distribution theory. Heterogeneous catalysis and biochemical reactions: mechanisms, mass and heat transfer, and reactor design. Gas-liquid reactions: mechanisms, mass transfer, and reactor design. Design heuristics. Microreactors.

Mode of delivery:

Lectures including exercises, face-toface teaching.

Learning activities and teaching methods:

Lectures 35 h, exercises 12 h, homework 12 h, self-study 74 h.

Target group:

Master’s degree students of Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

Courses 477201A Energy and Material Balances and 477202A Reactor Analysis are recommended beforehand.

Recommended optional programme components:

-

Recommended or required reading:

Nauman, E.B.: Chemical Reactor Design. New York, John Wiley & Sons.1987; Winterbottom, J.M. & King, M.B. (Editors) Reactor Design for Chemical Engineers. Padstow 1999, T.J. International Ltd. 442 s.
Additional literature: Gianetto, A. &Silveston, P.L.: Multiphase Chemical Reactors: Theory, Design, Scale-up. Hemisphere, Washington, D. 1986; Froment, G. & Bischoff, K.B.: Chemical Reactor Analysis and Design. New York, John Wiley & Sons. 1990; Hessel, V., Hardt, S. &Löwe, H.: Chemical Micro Process Engineering. Weinheim 2004, Wiley-VHC Verlag GmbH & Co. 674 p, Salmi, T., Mikkola, J.-P.&Wärnå, J. Chemical reaction engineering and reactor technology. Boca Raton 2011, CRC Press, 615 p.

Assessment methods and criteria:

Examination. Homework assignments affect the course grade. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Riitta Keiski

Working life cooperation:

No

Other information:

By means of the residence time distribution theory, students adopt a way of thinking in modeling which is based on the concept of probability.

477224S: Biorefineries, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Period 2 (autumn term)

Learning outcomes:

By completing the course the student understands the state-of-the-art technology level of the processing of biofuels, biochemicals and energy from lignocellulosic biomass. She/he can conclude technological and economical challenges facing the development work of biorefineries. She/he is able to apply performance criteria considering sustainable development.

Contents:

Historical background. Fossil and biomass raw material resources for energy production. Production of transportation fuels. Technology generations. Biorefineries and their categorisation. Lignocellulosic biorefineries. Production of biochemicals. Development phase of biorefineries: technical, economical and environmental considerations. Commercialisation state of nonwood biorefineries.

Mode of delivery:

Lectures and small group exercises. Occurring every two years.

Learning activities and teaching methods:

Lectures 30 h and self-study 100 h

Target group:

Master's students in the study options chemical engineering and bioprocess engineering

Prerequisites and co-requisites:

To understand the phenomena and operations present in processes, 488052A Introduction to Bioproduct and Bioprocess Engineering.

Recommended optional programme components:

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Recommended or required reading:

Lecture handouts

Assessment methods and criteria:

Examination and other evaluation methods

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Juha Tanskanen

Working life cooperation:

No

Other information:

-

477223S: Advanced Process Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477206S	Advanced Process Design	6.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring, period 4

Learning outcomes:

The student is able to produce a preliminary chemical process concept. She/he can apply systematic process synthesis tools, chemical process simulation tools and whole process performance criteria in the conceptual process design phase. Furthermore, the student is able to produce process design documents. The student will acquire skills how to work as a member in an industrial chemical process design project. She/he will experience by team work the hierarchical character of the conceptual process design, the benefits of the systematic working methods and the need to understand the whole process performance when optimal design is sought. The student understands the importance of innovation and creative work.

Contents:

Conceptual process design and hierarchical decision making. Heuristics of process design. Design methodology: synthesis, analysis and evaluation. Design cycle. Performance evaluation of the chemical processes. Team work and meetings.

Mode of delivery:

Design projects in small groups

Learning activities and teaching methods:

Project meetings 10h and project group work 120h

Target group:

Master's students of process and environmental engineering

Prerequisites and co-requisites:

Learning outcomes of 477203A Process Design or similar knowledge

Recommended optional programme components:

Part of Process Design Module

Recommended or required reading:

Seider, W.D., Seider, J.D. and Lewin, D.R. Product and process design principles: Synthesis, analysis and evaluation. John Wiley & Sons, 2004. (Parts) ISBN 0-471-21663-1

Assessment methods and criteria:

Project work with oral and written reporting. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

No

Other information:

-

A432230: Module of the Option/Chemical Engineering, 58 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

477306S: Non-ideal Reactors, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

Leikkaavuudet:

470222A	Reactor Analysis and Design II	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in the autumn semester during the 2nd period. It is recommended to complete the course at the fourth (1st Master's) autumn semester.

Learning outcomes:

After completing the course the student can analyse the effect of non-ideal mixing conditions on the behaviour of a reactor. He/she is capable of explaining the mechanisms of heterogeneous reactions, especially with methods that are used to analyse the effect of mass and heat transfer on the observed kinetics of heterogeneous reactions. The student has rudimentary skills to conduct demanding reactor analysis and to design heterogeneous reactors.

Contents:

Mixing models of a flowing material. Residence time distribution theory. Heterogeneous catalysis and biochemical reactions: mechanisms, mass and heat transfer, and reactor design. Gas-liquid reactions: mechanisms, mass transfer, and reactor design. Design heuristics. Microreactors.

Mode of delivery:

Lectures including exercises, face-toface teaching.

Learning activities and teaching methods:

Lectures 35 h, exercises 12 h, homework 12 h, self-study 74 h.

Target group:

Master's degree students of Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

Courses 477201A Energy and Material Balances and 477202A Reactor Analysis are recommended beforehand.

Recommended optional programme components:

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Recommended or required reading:

Nauman, E.B.: Chemical Reactor Design. New York, John Wiley & Sons.1987; Winterbottom, J.M. & King, M.B. (Editors) Reactor Design for Chemical Engineers. Padstow 1999, T.J. International Ltd. 442 s. *Additional literature:* Gianetto, A. &Silveston, P.L.: Multiphase Chemical Reactors: Theory, Design, Scale-up. Hemisphere, Washington, D. 1986; Froment, G. & Bischoff, K.B.: Chemical Reactor Analysis and Design. New York, John Wiley & Sons. 1990; Hessel, V., Hardt, S. &Löwe, H.: Chemical Micro Process Engineering. Weinheim 2004, Wiley-VHC Verlag GmbH & Co. 674 p, Salmi, T., Mikkola, J.-P.&Wärnå, J. Chemical reaction engineering and reactor technology. Boca Raton 2011, CRC Press, 615 p.

Assessment methods and criteria:

Examination. Homework assignments affect the course grade. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Riitta Keiski

Working life cooperation:

No

Other information:

By means of the residence time distribution theory, students adopt a way of thinking in modeling which is based on the concept of probability.

477309S: Process and Environmental Catalysis, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

470226S	Catalytic Processes	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester, during 1 st period. It is recommended to complete the course at the fourth (1 st Master's) autumn semester.

Learning outcomes:

After the course the student is able to define the fundamentals and history of catalysis and he/she can explain the economical and environmental meaning of catalysis. The student is capable of specifying the design, selection and testing of catalysts and catalytic reactors and processes.
He/she is able to explain the most important industrial catalytic processes, the use of catalysts in environmental technology, catalyst research and the significance of an interdisciplinary approach in the preparation, development and use of catalysts. He/she recognizes the connection between catalysis and green chemistry and the role of catalysis in sustainable processes and energy production.

Contents:

Definition of catalysis and a catalyst, history of catalysis, economical, social and environmental meaning. Preparation of catalysts, principles, selection, design and testing of catalysts and catalytic reactors. Kinetics and mechanisms of catalytic reactions, catalyst deactivation. Industrially important catalysts, catalytic reactors and catalytic processes. Environmental catalysis. Catalysts in air pollution control and purification of waters. Catalysis and green chemistry. Catalysis for sustainability. Principles in the design of catalytic processes.

Mode of delivery:

Lectures including design exercises, face-to-face teaching.

Learning activities and teaching methods:

Lectures 40 h, exercises 10 h, homework 30 h, self-study 53 h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I, 488010P Introduction to Process and Environmental Engineering II, and 780109P Basic Principles in Chemistry are recommended beforehand.

Recommended optional programme components:

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Recommended or required reading:

Lecture handout; Richardson, J.T.: Principles of Catalyst Development. New York. 1989, 288 pp.; Janssen, F.J.J.G. & van Santen, R.A.: Environmental Catalysis. NIOK, Catalytic Science Series, Vol. 1. 1999. 369 pp. *Additional literature:*Ertl, G., Knözinger, J. & Weitkamp, J.: Handbook of Heterogeneous Catalysis. Vol. 1-5. Weinheim. 1997, 657 p.; Thomas, J.M. & Thomas, W.J.: Principles and Practice of Heterogenous Catalysis. Weinheim 1997. 657 pp.; Somorjai, G.A.: Surface Chemistry and Catalysis. New York 1994, 667 pp.; van Santen, R.A., van Leuwen, P.W.N.M., Mouljin, J.A. & Averill, B.A.: Catalysis: An Integrated Approach, 2nd ed. Studies in Surface Science and Catalysis 123. Amsterdam 1999, Elsevier Sci. B.V. 582 pp.

Assessment methods and criteria:

Written examination and homework.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Post-doctoral research fellow Tanja Kolli

Working life cooperation:

No

Other information:

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477310S: Advanced Catalytic Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

Leikkaavuudet:

480360S	Catalysts in Environmental Technology	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 nd period every even year.

Learning outcomes:

After completing the course the student can explain the interdisciplinary connection of catalysis with material and surface science, define new catalyst preparation methods and application areas, catalytic reaction and process engineering, and methods in catalyst research (experimental and computational methods). He/she is also able to design and do research work by emphasising research methods and innovations in catalysis. He/she is able to explain the latest knowledge connected to catalyst research and applications. He/she is also capable of explaining the relation and differences between heterogeneous, homogeneous and biocatalysis.

Contents:

The course contents are divided into the following themes 1) surface chemistry and catalysis, 2) new catalyst preparation methods, 3) catalysis for a sustainable production and energy, and green chemistry and engineering and catalysis, 4) design of catalysts and catalytic processes (reactor and process intensification, process improvements, new catalysts and catalytic processes, new opportunities by catalysis), 5) phenomena integration and catalysis and 6) new innovations in catalyst research.

Mode of delivery:

Lectures and a seminar work, face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h, seminar work 25 h, self-study 78 h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477309S Process and Environmental Catalysis and 488204A Air Pollution Control Engineering.

Recommended optional programme components:

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Recommended or required reading:

Thomas, J.M. & Thomas, W.J.: Principles and Practice of Heterogeneous Catalysis. Weinheim 1997. 657 p.; Somorjai, G.A.: Surface Chemistry and Catalysis. New York 1994. 667 p.; Van Santen, R.A., van Leuwen, P.W.N.M., Moulijn, J.A. & Averill, B.A.: Catalysis: An Integrated Approach, 2nd. edition. Research Articles.
Further literature: Ertl, G., Knözinger, H. &Weitkamp, J.: Handbook of Heterogeneous Catalysis. Vol. 1-5. Weinheim 1997; Morbidelli, M., Gavriilidis, A. &Varma, A.: Catalyst Design, Optimal Distribution of Catalyst in Pellets, Reactors, and membranes. New York 2001, Cambridge University Press. 227 p.; Anastas, P.T. & Crabtree, R.H. (eds.): Green catalysis, volume 2: Heterogeneous Catalysis. Weinheim 2009, 338 p.

Assessment methods and criteria:

Written examination and a seminar work including reporting and presentation. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University researcher Satu Ojala

Working life cooperation:

No

Other information:

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477311S: Advanced Separation Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 nd period every odd year

Learning outcomes:

After completing the course the student is able to review the most recent methods and techniques for separation and purification of components and products, e.g. in the chemical, food, and biotechnology industries. He/she is able to define the principles of green separation processes and their research status and potentiality in industrial applications.

Contents:

The course is divided into lectures given by visiting experts from different fields (industry, research institutes and universities) and seminars given by students and senior researchers. The lectures open up the newest innovations in separation and purification technologies. The lectures can include for example the following themes: Phenomena in Supercritical fluid extraction, Pressure-activated membrane processes, Reverse osmosis, Nanofiltration, Ultrafiltration, Microfiltration, Pervaporation, Polymer membranes, Dialysis, Electrolysis and Ion-exchange, Forces for adsorption and Equilibrium adsorption isotherms, Sorbent materials and heterogeneity of surfaces, Predicting mixture adsorption, Rate processes in adsorption/adsorbers and adsorber dynamics, Cyclic adsorption processes, Temperature and pressure swing adsorption. Innovative separation methods, Phenomena integration, New hybrid materials as separation agents. Fluids and their application in gas extraction processes, Solubility of compounds in supercritical fluids and phase equilibrium.Extraction from solid substrates: Fundamentals, hydrodynamics and mass transfer, applications and processes (including supercritical water and carbon dioxide). Counter-current multistage extraction: Fundamentals and methods, hydrodynamics and mass transfer, applications and processes. Solvent cycles, heat and mass transfer, methods for precipitation.Supercritical fluid chromatography.Membrane separation of gases at high pressures.The topics of the course seminars will change annually depending on the research relevance.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h, seminar work 25 h, 78 h

Target group:

Master’s degree students of the Process and Environmental Engineering study programmes

Prerequisites and co-requisites:

The courses 477304A Separation Processes and 477308S Multicomponent Mass Transfer are recommended beforehand

Recommended optional programme components:

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Recommended or required reading:

The course literature will be chosen when the course is planned. Latest scientific research articles. Further literature: Green Separation Processes, Edited by: Afonso, A.M. & Crespo, J.G. 2005 Wiley-VCH, Separation Processes in the Food and Biotechnology Industries, Edited by: Grandison, A.S. & Lewis, M.J. 1996 Woodhead Publishing.

Assessment methods and criteria:

Portfolio or written examination and a seminar work including reporting and presentation.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Riitta Keiski

Working life cooperation:

No

Other information:

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477308S: Multicomponent Mass Transfer, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ainassaari, Kaisu Maritta, Muurinen, Esa Ilmari

Opintokohteen kielet: Finnish

Leikkaavuudet:

470302S	Multicomponent Separation	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish, can be completed in English as a book examination

Timing:

Implementation in spring semester during 4 th period. It is recommended to complete the course at the fourth (first Master's) spring semester

Learning outcomes:

Upon completing the required course work the student is able to formulate matrix equations describing mass transfer in multicomponent systems using the theory of Maxwell-Stefan and the laws of Fick for laminar and turbulent systems. He/she is also able to define bootstrap relations to bind the general equations to the physical situation of the problem, and is capable of applying the methods to estimate diffusion and mass transfer coefficients. In addition, he/she is able to describe the theories for mass transfer through phase interface, to calculate the multicomponent phase equilibrium formed by mass transfer across fluid interphase with equations of state and activity coefficient correlations, and to explain the experimental methods to measure vapour-liquid equilibrium and the methods to estimate the validity of measured values. After completing the course the student is capable of applying models of mass transfer and phase equilibrium to model and design multicomponent processes (e.g. distillation and condensation) based on diffusion.

Contents:

Maxwell-Stefan equations. Fick’s law.Estimation of diffusion coefficients.Multicomponent systems. Mass transfer coefficients. Film theory. Mass transfer models for dynamic systems.

Mass transfer in turbulent flows. Simultaneous mass and heat transfer. Vapour-liquid equilibrium and experimental determination. Mass transfer models in multicomponent distillation. Condensation of vapour mixtures.

Mode of delivery:

Face-to-face teaching in Finnish (book examination in English)

Learning activities and teaching methods:

Lectures 30 h, exercises 8 h, simulation exercise 15 h and self-study 80 h. For foreign students: a written examination based on given literature and simulation exercise

Target group:

Master's degree students of process and environmental engineering

Prerequisites and co-requisites:

Courses 477303A Mass Transfer or 477312A Heat and Mass Transfer, 477304A Separation Processes and 031019P Matrix Algebra are recommended beforehand

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Taylor, R. & Krishna, R.: Multicomponent Mass Transfer, John Wiley & Sons, 1993, 579 p.; Henley, E.J. &Seader, J.D.: Equilibrium-stage Separation Operations in Chemical Engineering, John Wiley & Sons, 1982, 742 p.
Additional literature: Walas, S.M.: Phase Equilibria in Chemical Engineering, Butterworth Publishers, 1985, 671 pp.

Assessment methods and criteria:

Examination or a learning diary and a simulation exercise. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Laboratory manager Dr Esa Muurinen

Working life cooperation:

No

Other information:

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477305S: Flow Dynamics, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Muurinen, Esa Ilmari

Opintokohteen kielet: Finnish

Leikkaavuudet:

470303S	Flow Dynamics	3.5 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish, can be completed in English as a book examination (see Mode of Delivery)

Timing:

Implementation in autumn semester during 1st period. It is recommended to complete the course at the fourth (1st Master's) autumn semester.

Learning outcomes:

After completing the course the student is able to formulate the partial differential equations describing flow of fluids and to solve these equations in systems with simple geometry using difference, finite element and finite volume methods. The student is also able to formulate and solve the equations describing flow of granular material based on molecular dynamics. He/she is able to choose the experimental methods for validation of the calculated results and the methods to measure the most common properties describing fluid flow. After the course the student is able to model simple flow configurations using CFD and to design experimental systems and measurements for verifying computational results.

Contents:

Equations in fluid dynamics. Partial differential equations. Difference method. Graphical representation. Modelling the turbulence. Finite element method. Finite volume method. Molecular dynamics. Experimental fluid dynamics.

Mode of delivery:

Lectures and compulsory exercise done in small groups (in the English version, compulsory simulation exercise in small groups and a book exam, which replaces the lectures given in English)

Learning activities and teaching methods:

Lectures 25 h, and exercise 15 h, self-study 93 h. For foreign students written examination based on given literature and a simulation exercise.

Target group:

Master's degree students of process and environmental engineering.

Prerequisites and co-requisites:

Courses 477301A Momentum Transfer or 477052A Fluid Mechanics, 031019P Matrix Algebra and 031022P Numerical Methods are recommended beforehand.

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Anderson J.D.: Computational Fluid Dynamics, McGraw-Hill, 1995, 608 p. Hämäläinen J. & Järvinen J.: Elementtimenetelmävirtauslaskennassa, CSC – Tieteellinenlaskenta Oy, 1994, 212 p. Versteeg, H.K. &Malalasekera, W.: An Introduction to Computational Fluid Dynamics, Longman Scientific and Technical, 1995, 257 p. Pöschel, T. & Schwager, T.: Computational Granular Dynamics, 2005, 322 p. Tavoularis, S.: Measurements in Fluid Mechanics, 2005, 354 p.
Additional literature: Shaw, C.T.: Using Computational Fluid Dynamics, Prentice Hall, 1992, 251 p.; Nakayama, Y. & Boucher, R.F.: Introduction to Fluid Mechanics, Arnold, 1999, 308 p.: Haataja J., Käpyaho, J. &Rahola, J.: Numeerisetmenetelmät. CSC – Tieteellinenlaskenta Oy, 1993, 236 p; Rathakrishnan, E.: Instrumentation, Measurements, and Experiments in Fluids, 2007, 492 p.

Assessment methods and criteria:

Examination or a learning diary and exercise.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Person responsible:

Laboratory manager Dr Esa Muurinen

Working life cooperation:

No

Other information:

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477204S: Chemical Engineering Thermodynamics, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Period 1 (autumn term)

Learning outcomes:

By completing the course the student understands classical thermodynamics from a chemical engineering viewpoint. Especially she/he can explain the pVT behaviour of pure substances and understands the thermodynamic properties of mixtures. The student can classify the thermodynamic models describing, for example, liquid mixtures or electrolytes. The student can select appropriate models for gas, vapour and liquid phases. In addition, the student can solve process models, phase equilibrium and chemical reaction equilibrium problems, and more generally, is able to evaluate chemical processes using thermodynamic analysis tools.

Contents:

Mass and energy balances, pVT behaviour of pure substances, thermodynamic properties of fluids, thermodynamics of electrolytes, chemical reaction equilibrium, vapour/liquid equilibrium, calculation of thermodynamical state functions, thermodynamic analysis of processes.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 34h and self-study 99h

Target group:

Students in the study options Process Design and Chemical Engineering

Prerequisites and co-requisites:

Thermodynamic equilibria

Recommended optional programme components:

Part of the Process Design Module

Recommended or required reading:

Lecture handout. Material given during the lectures. Additional literature, Smith, J.M. & Van Ness, H.C. Introduction to Chemical Engineering Thermodynamics. McGraw-Hill, 1987.

Assessment methods and criteria:

Combination of examinations and exercises
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Juha Tanskanen

Working life cooperation:

No

Other information:

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477209S: Chemical Process Simulation, 5 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jani Kangas
Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Autumn, periods 1-2

Learning outcomes:

The student has the ability to convert a process flow diagram into a form compatible with process simulation software. She/he has skills to evaluate realistic process conditions in a typical chemical process. The student can apply proper thermodynamic property models for simulation purposes. She/he can name the advantages and disadvantages of using the sequential modular solving approach in chemical process modelling and simulation. She/he is capable of solving a computer simulation case for a typical chemical process. The student is able to analyze the simulation results with respect to realistic values.

Contents:

The structure of a process simulator. Thermodynamic property models and databanks. Degrees of freedom analysis. Steady-state simulation. Sequential modular, and equation-oriented approaches in simulation. Numerical solving methods. Heuristics for chemical process simulation.

Mode of delivery:

Face-to-face teaching, introductory examples and group exercises with process simulation software.

Learning activities and teaching methods:

Guided exercises 32h and group work 98h

Target group:

Master's students in Chemical Engineering study option

Prerequisites and co-requisites:

477204S Chemical Engineering Thermodynamics or equivalent knowledge

Recommended optional programme components:

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Recommended or required reading:

Material distributed on lectures. Additional literature, Turton, R., Bailie, R.C., Whiting, W.B. & Shaeiwitz, J. A.: Analysis, synthesis, and design of chemical processes. 3 rd Ed. Prentice Hall. (Parts) ISBN 0-13-512966-4.

Assessment methods and criteria:

Group exercise reports and a simulation study exam performed individually.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr Jani Kangas

Working life cooperation:

No

Other information:

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477524S: Process Optimization, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay477524S	Process Optimization (OPEN UNI)	5.0 op
477504S	Process Optimization	4.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring semester, the 3th period. Recommended for 1st year M.Sc. students.

Learning outcomes:

Student can use and apply standard unconstrained and constrained optimization methods. Student can define and identify optimization problems. Student is able to summarize the role of optimization in process engineering.

Contents:

Basic concepts of optimization. Optimization of unconstrained and constrained functions. Linear programming. Trajectory optimization. Hierarchical optimization. Intelligent methods in optimization. Applications in process engineering.

Mode of delivery:

Face-to-face teaching and exercises as group work

Learning activities and teaching methods:

The amount of guided teaching is 40 hrs. Contact teaching includes, depending on situation, lectures, group work and tutored group work. During self-study time student does independent or group work.

Target group:

M.Sc. students of process and environmental engineering and M.Sc. students interested in process optimization. Exchange and other international students.

Prerequisites and co-requisites:

No prerequisites but basic understanding on numerical methods and process modelling are useful.

Recommended optional programme components:

See prerequisites

Recommended or required reading:

Reading materials. Ray, W.H. & Szekely, J. (1973) Process Optimization with Applications in Metallurgy and Chemical Engineering. John Wiley & Sons.

Assessment methods and criteria:

This course uses continuous assessment that includes solved exercises and lecture exams. Final exam is also possible.

Grading:

The course unit uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

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477223S: Advanced Process Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477206S	Advanced Process Design	6.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring, period 4

Learning outcomes:

The student is able to produce a preliminary chemical process concept. She/he can apply systematic process synthesis tools, chemical process simulation tools and whole process performance criteria in the conceptual process design phase. Furthermore, the student is able to produce process design documents. The student will acquire skills how to work as a member in an industrial chemical process design project. She/he will experience by team work the hierarchical character of the conceptual process design, the benefits of the systematic working methods and the need to understand the whole process performance when optimal design is sought. The student understands the importance of innovation and creative work.

Contents:

Conceptual process design and hierarchical decision making. Heuristics of process design. Design methodology: synthesis, analysis and evaluation. Design cycle. Performance evaluation of the chemical processes. Team work and meetings.

Mode of delivery:

Design projects in small groups

Learning activities and teaching methods:

Project meetings 10h and project group work 120h

Target group:

Master's students of process and environmental engineering

Prerequisites and co-requisites:

Learning outcomes of 477203A Process Design or similar knowledge

Recommended optional programme components:

Part of Process Design Module

Recommended or required reading:

Seider, W.D., Seider, J.D. and Lewin, D.R. Product and process design principles: Synthesis, analysis and evaluation. John Wiley & Sons, 2004. (Parts) ISBN 0-471-21663-1

Assessment methods and criteria:

Project work with oral and written reporting. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

No

Other information:

-

477224S: Biorefineries, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Period 2 (autumn term)

Learning outcomes:

By completing the course the student understands the state-of-the-art technology level of the processing of biofuels, biochemicals and energy from lignocellulosic biomass. She/he can conclude technological and economical challenges facing the development work of biorefineries. She/he is able to apply performance criteria considering sustainable development.

Contents:

Historical background. Fossil and biomass raw material resources for energy production. Production of transportation fuels. Technology generations. Biorefineries and their categorisation. Lignocellulosic biorefineries. Production of biochemicals. Development phase of biorefineries: technical, economical and environmental considerations. Commercialisation state of nonwood biorefineries.

Mode of delivery:

Lectures and small group exercises. Occurring every two years.

Learning activities and teaching methods:

Lectures 30 h and self-study 100 h

Target group:

Master’s students in the study options chemical engineering and bioprocess engineering

Prerequisites and co-requisites:

To understand the phenomena and operations present in processes, 488052A Introduction to Bioproduct and Bioprocess Engineering.

Recommended optional programme components:

-

Recommended or required reading:

Lecture handouts

Assessment methods and criteria:

Examination and other evaluation methods

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Juha Tanskanen

Working life cooperation:

No

Other information:

-

477207S: Industrial Water and Wastewater Technologies, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tiina Leiviskä

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish. The course can be completed in English as a book examination.

Timing:

Spring period 3

Learning outcomes:

After completing the course student knows water use and management of water-intensive industrial sectors. He/she knows industrial raw water, process water and waste water treatment technologies and can evaluate optimal usage of water by considering external requirements as well as technical and economical factors. He/she can select water treatment operations on the basis of case-specific needs.

Contents:

Industrial water management. Physical, chemical and biological water treatment operations used by process industry. Detailed description of chemical water treatment processes. Pre-treatment of raw water, treatment of process water and water reuse, waste water treatment, disinfection.

Mode of delivery:

Lectures, group work and self-study

Learning activities and teaching methods:

Lectures 30h, group work 10h and self-study 90h

Target group:

Master's students e.g. in the Process Design study option

Prerequisites and co-requisites:

-

Recommended optional programme components:

Part of Process Design Module

Recommended or required reading:

Material distributed in lectures. Additional literature, McCabe, W., Smith, J., Harriot, P.: Unit Operations of Chemical Engineering; Sincero, A., Sincero, A.: Physical-Chemical Treatment of Water and Wastewater, IWA Publishing, CRC Press

Assessment methods and criteria:

The students will be making an essay and a group exercise, which both will be evaluated. Student will participate in final exam after the course.

Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr Tiina Leiviskä

Working life cooperation:

No

Other information:

-

H432229: Module of the Option/Extractive Metallurgy, 60 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

A432231: Module of the Option/Extractive Metallurgy, 30 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

477412S: Phenomena-based modelling in extractive metallurgy, 10 op

Voimassaolo: 01.08.2011 - 31.07.2017
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Eetu-Pekka Heikkinen
Opintokohteen kielet: Finnish
Leikkaavuudet:

477421S	Thermodynamics in Metallurgy	6.0 op

ECTS Credits:

10 cr / 270 hours of work

Language of instruction:

Finnish

Timing:

The course is given in the autumn semester, during periods I and II. It is recommended to complete the course at the 4th autumn semester.

Learning outcomes:

Students passing the course are familiar with the most important computational methods used to investigate the most essential phenomena in the research and development of metallurgical processes. Students can e.g. calculate thermodynamic equilibria, read and construct phase stability diagrams as well as other diagrams used in the investigation of pyrometallurgical and electrochemical reactions, describe the role of inclusions in metal production, describe the structure of metallurgical slags, etc. It should however be noted that these are only examples since the contents of the course are under continuous development and therefore more detailed learning outcomes are given each year at the beginning of each course.

Contents:

Models and methods that are used to investigate the most essential chemical and physical phenomena in the research and development of metallurgical processes

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Individual and group exercises as well as contact-education (90 hours) that supports these exercises

Target group:

Students of process metallurgy

Prerequisites and co-requisites:

Knowledge and skills corresponding with the knowledge and skills that are obtained from the Bachelor-level-studies in the programme of process or environmental engineering are required as prerequisities. In order to get credits from this course, bachelor thesis must be completed.

Recommended optional programme components:

The module of process metallurgy consists of courses 477412S, 477413S and 477414S.

Recommended or required reading:

Material will be distributed during lectures and exercises. It is also available via courses www-site.

Assessment methods and criteria:

Individual and group-exercises
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Eetu-Pekka Heikkinen

Working life cooperation:

No

Other information:

It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun.

477413S: Experimental Research in Extractive Metallurgy, 10 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Tanskanen

Opintokohteen kielet: Finnish

ECTS Credits:

10 cr / 270 hours of work

Language of instruction:

Finnish

Timing:

The course is given in the spring semester, during periods III and IV. It is recommended to complete the course at the 4th spring semester.

Learning outcomes:

Students passing the course are familiar with the most important experimental and analytical methods used in the laboratory scale research of materials and metallurgical processes. Students can determine and separate research problems to reasonable pieces, collect the background information, select the reasonable methods and make the research and reporting on planned schedule. Additionally, students can observe the metallurgical phenomena and their interconnections and consequences. It should also be noted that the contents of the course are under continuous development and therefore more detailed learning outcomes are given each year at the beginning of each course.

Contents:

Typical experimental and analytical methods used to research the high temperature modification and behaviour (oxidation, reduction, melting, surface phenomena, kinetics) of materials. Determining and separating research problems to reasonable pieces, making the background research, selecting suitable methods, reporting and presenting the results.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Group exercises and contact-education (90 hours) that supports these exercises

Target group:

Students of process metallurgy

Prerequisites and co-requisites:

Knowledge and skills corresponding with the knowledge and skills that are obtained from the Bachelor-level-studies in the programme of process or environmental engineering are required as prerequisities.In order to get credits from this course, bachelor thesis must be completed.

Recommended optional programme components:

The module of process metallurgy consists of courses 477412S, 477413S and 477414S

Recommended or required reading:

Material will be distributed during lectures and exercises. It is also available via courses www-site.

Assessment methods and criteria:

Group-exercises and reports
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Pekka Tanskanen

Working life cooperation:

No

Other information:

It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun. The number of students participating in this course may be limited.

477414S: Process Simulation in Extractive Metallurgy, 10 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Fabritius, Timo Matti Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

477422A	Metallurgical Processes	6.0 op

ECTS Credits:

10 cr / 270 hours of work

Language of instruction:

Finnish

Timing:

The course is held in the autumn semester, during periods I and II. It is recommended to complete the course at the 5th autumn semester.

Learning outcomes:

Students passing the course are familiar with the metal production processes and metallurgical unit operations used in Finland and they can create process simulations describing these processes. Additionally, students can identify the boundary conditions of the process simulations created by e.g. availability of the data and possibilities to model the phenomena involved in these processes. It should also be noted that the contents of the course are under continuous development and therefore more detailed learning outcomes are given each year at the beginning of each course.

Contents:

The most important metal production processes and metallurgical unit operations used in Finland as well as modelling and simulation of these processes.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Group exercises and contact-education (90 hours) that supports these exercises

Target group:

Students of process metallurgy

Prerequisites and co-requisites:

Knowledge and skills corresponding with the knowledge and skills that are obtained from the Bachelor-level-studies in the programme of process or environmental engineering are required as prerequisities. In order to get credits from this course, bachelor thesis must be completed.

Recommended optional programme components:

The module of process metallurgy consists of courses 477412S, 477413S and 477414S

Recommended or required reading:

Material will be distributed during lectures and exercises. It is also available via courses www-site.

Assessment methods and criteria:

Group exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Timo Fabritius

Working life cooperation:

No

Other information:

It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun

A432232: Module of the Option/Mineral Processing, 60 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

477710A: Basic Course in Geology, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Heli Rautjärvi, Seppo Gehör
Opintokohteen kielet: Finnish
Leikkaavuudet:

477701A	Basic Course in Geology	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish

Timing:

In period 1 (autumn term)

Learning outcomes:

-

Contents:

-

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures, practicals, mine visit (only if resources are allowing), final exams for the lectures and practicals separately

Target group:

Master's students in the study option Mineral Processing of the study programmes Process Engineering and Environmental Engineering

Prerequisites and co-requisites:

The Bachelor level studies of process or environmental engineering study programmes or respective knowledge, and the preceding Master level studies or respective knowledge

Recommended optional programme components:

The other courses of the Master's phase curriculum

Recommended or required reading:

Materials delivered at the lectures, practicals and/or in the Optima

Assessment methods and criteria:

Final exams for the lectures and practicals separately

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Seppo Gehör or NN

Working life cooperation:

No

Other information:

-

477704A: Principles of Mineral Processing, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Saija Luukkanen
Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

In period 2 (autumn term). It is recommedable to take this course on the 1st year of the Master's degree phase of his/her studies i.e. the fourth year of all

Learning outcomes:

After the course the student knows the principles of mineral processing and can explain the basic processes therein. Additionally the student has acquired the skill to recognize the essential equipment used in mineral processing and their operation. Further, the student can explain the basics of the economics of mineral processing

Contents:

Grinding methods, separation methods, process control; practical examples of mineral processing; unit processes related to optimal mineral processing

Mode of delivery:

Implemented as face-to-face teaching

Learning activities and teaching methods:

Lectures and practical exercises, final examination

Target group:

The students of the Mineral Processing study option in the study programmes Process Engineering or Environmental Engineering

Prerequisites and co-requisites:

The Bachelor level studies of process or environmental engineering study programmes or respective knowledge, and the preceding Master level studies or respective knowledge

Recommended optional programme components:

The other courses of the Master's phase curriculum

Recommended or required reading:

Materials delivered at the lectures, practicals and/or in Optima

Assessment methods and criteria:

Final examination.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Hannu Kuopanportti / NN

Working life cooperation:

No

Other information:

-

477716A: Surface Chemistry Principles and Applications in Mineral and Mining Technology, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477703A	Surface Chemistry Principles of Minerals	3.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish/English

Timing:

In spring period 3. It is recommedable to take this course on the 1st year of the Master's degree phase, i.e. the 4th year of all.

Learning outcomes:

After completing the course, student can describe mineral engineering processes and unit operations on the basis of physical chemistry. The course introduces students to surface phenomena of physical chemistry.

Contents:

Thermodynamic basic equations; chemical interactions, especially those of boundary surfaces; zeta potential, total surface charges; bubbles; surface reagents, etc.

Mode of delivery:

Implemented as face-to-face teaching (or by distant learning)

Learning activities and teaching methods:

Lectures, exercises

Target group:

The students of the Mineral Processing study option in the study programmes Process Engineering or Environmental Engineering

Prerequisites and co-requisites:

The Bachelor level studies of process or environmental engineering study programmes or respective knowledge, and the preceding Master level studies or respective knowledge

Recommended optional programme components:

The other courses of the Master's phase curriculum

Recommended or required reading:

Materials delivered at the lectures or electrically

Assessment methods and criteria:

Scored excercises. Final examination.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Jaakko Rämö (Thule Institute, University of Oulu)

Working life cooperation:

No

Other information:

Resources allowing, the course is given for the LTU students by an electronic connection (as distant learning)

477711S: Rock and Mining Engineering, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477702A	Rock Engineering	5.0 op
477707A	Mining Engineering	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Autumn term, period 2

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and a final examination

Target group:

Especially Master's students in the study option Mineral Processing of the study programmes Process Engineering and Environmental Engineering

Prerequisites and co-requisites:

The Bachelor level studies of process or environmental engineering study programmes or respective knowledge, and the preceding Master level studies or respective knowledge

Recommended optional programme components:

The other courses of the Master's phase curriculum

Recommended or required reading:

Materials delivered during the lectures and/or in Optima. *Additional literature*: Hakapää A. &. Lappalainen P. (eds.) 2011: Kaivos- ja louhintatekniikka. Opetushallitus, Kaivannaisteollisuusyhdistys. 388 p. ISBN 978-952-13-4615-6.

Assessment methods and criteria:

Final examination

Grading:

Numerical grading scale 1-5 or fail

Person responsible:

Professor Mikael Rinne (Aalto-university) or N.N.

Working life cooperation:

No

Other information:

-

477712S: Phenomena in Mineral Processing, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannu Kuopanportti, Harri Kosonen

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish

Timing:

In period 4 (spring). It is recommedable to take this course on the 1st year of the Master's degree phase of the studies i.e. on the fourth year of all.

Learning outcomes:

After the course the student is able to explain and understand the physical and chemical phenomena that effect on the operation of an enrichment method. By understanding the phenomena the student can explain the reasons for the process changes, and can explain how the process device works and can optimize the process conditions and the equipment parameters.

Contents:

Basic methods and equipment of crushing and grinding. Enrichment based on sorting. Grinding-conditioning of flotation, flotation concentration. Beneficiation methods and equipment based on density differences.Magnetic and electrostatic enrichment. Beneficiation methods based on leaching.

Mode of delivery:

Implemented as face-to-face teaching

Learning activities and teaching methods:

Lectures, final examination

Target group:

The students of the Mineral Processing study option in the degree programmes Process Engineering or Environmental Engineering

Prerequisites and co-requisites:

The Bachelor level studies of process or environmental engineering study programmes or respective knowledge, and the preceding Master level studies or respective knowledge

Recommended optional programme components:

The other courses of the Master's phase curriculum

Recommended or required reading:

Lecture materials delivered in the lectures and/or in Optima

Assessment methods and criteria:

Final examination for the lectures.

Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Prof. Hannu Kuopanportti / NN

Working life cooperation:

No

Other information:

-

477713S: Automation in Mineral Processing, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: Finnish

Leikkaavuudet:

477510S	Automation in Mineral Processing	5.0 op
477724S	Numerical Mine Modelling	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Implementation in the 4th period (spring term)

Learning outcomes:

The target is to give the students the skills to understand and develop models for minerals processing and apply these models in process monitoring and control.

Contents:

Models for processes like crushing, grinding, flotation, leaching, separation etc. Examples how to use these models in process control and what kind of benefits can be drawn from their use.

Mode of delivery:

Lectures and demonstrations

Learning activities and teaching methods:

Lectures during one period

Target group:

Master's students in process and environmental engineering. Exchange students.

Prerequisites and co-requisites:

Basic knowledge in minerals processing and control engineering

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes in English

Assessment methods and criteria:

Continuous evaluation: lectures and test

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Leiviskä

Working life cooperation:

No

Other information:

-

488115A: Geomechanics, 5 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Kauko Kujala
Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course unit is given in the spring semester, during period 3

Learning outcomes:

Have a clear understanding of mechanical behaviour of soil structures in loading and environmental conditions. Understand design and dimensioning principles and can explain environmental aspects of soil behaviour.

Contents:

Origins and composition of soils, classification of soils, stress and strains in soils, mechanical properties of soils, stability of slopes, bearing capacity of foundation, seepage analyses, freezing and thawing of soils, site investigations and in situ testing.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (40 h) and calculation exercises (20 h) also independent work (75 h)

Target group:

Students in Bachelor program of Environmental Engineering

Prerequisites and co-requisites:

No

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout and other materials delivered in lectures

Assessment methods and criteria:

Examination
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Kujala

Working life cooperation:

No

Other information:

-

477207S: Industrial Water and Wastewater Technologies, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Tiina Leiviskä
Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish. The course can be completed in English as a book examination.

Timing:

Spring period 3

Learning outcomes:

After completing the course student knows water use and management of water-intensive industrial sectors. He/she knows industrial raw water, process water and waste water treatment technologies and can evaluate optimal usage of water by considering external requirements as well as technical and economical factors. He/she can select water treatment operations on the basis of case-specific needs.

Contents:

Industrial water management. Physical, chemical and biological water treatment operations used by process industry. Detailed description of chemical water treatment processes. Pre-treatment of raw water, treatment of process water and water reuse, waste water treatment, disinfection.

Mode of delivery:

Lectures, group work and self-study

Learning activities and teaching methods:

Lectures 30h, group work 10h and self-study 90h

Target group:

Master's students e.g. in the Process Design study option

Prerequisites and co-requisites:

-

Recommended optional programme components:

Part of Process Design Module

Recommended or required reading:

Material distributed in lectures. Additional literature, McCabe, W., Smith, J., Harriot, P.: Unit Operations of Chemical Engineering; Sincero, A., Sincero, A.: Physical-Chemical Treatment of Water and Wastewater, IWA Publishing, CRC Press

Assessment methods and criteria:

The students will be making an essay and a group exercise, which both will be evaluated. Student will participate in final exam after the course.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr Tiina Leiviskä

Working life cooperation:

No

Other information:

-

488221S: Environmental Load of Industry, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Niina Koivikko

Opintokohteen kielet: English

Leikkaavuudet:

488215S	Industry and Environment	5.0 op
488205S	Environmental Load of Process Industry	4.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during 3 rd period.

Learning outcomes:

The student is able to identify the essential features of the environmental load in different types of (chemical, wood, metallurgical, etc.) industry. He/she is able to explain the type, quality, quantity and sources of the emissions. The student is familiarized with the main emission control systems and techniques in different industrial sectors. He/she has the skills to apply BAT-techniques in emission control. The student can explain the environmental management system of an industrial plant and is able to apply it to an industrial plant.

Contents:

Effluents: types, quality, quantity, sources. Unit operations in managing effluents, comprehensive effluent treatment. Environmental management systems, environmental licences, environmental reporting and BAT.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 40 h, self-study 93h.

Target group:

Master’s degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I, 488011P Introduction to Process and Environmental Engineering II, 488204S Air Pollution Control Engineering and 488110S Water and Wastewater Treatment recommended before-hand.

Recommended optional programme components:

-

Recommended or required reading:

Material represented in lectures and in the Optima environment.

Assessment methods and criteria:

Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:

University researcher Satu Ojala

Working life cooperation:

No

Other information:

Expert lecturers may be invited from industry to give specific lectures related to the organization.

488203S: Industrial Ecology, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Väisänen, Virpi Maria

Opintokohteen kielet: English

Leikkaavuudet:

ay488203S	Industrial Ecology and Recycling	5.0 op
480370S	Industrial Ecology and Recycling	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 th period.

Learning outcomes:

Upon completion of the course, the student will be able to use the tools of industrial ecology and apply them to industrial activity. The student can also analyze the interaction of industrial, natural and socio-economic systems and able to judiciously suggest changes to industrial practice in order to prevent negative impacts. The student can also analyze the examples of industrial symbioses and eco-industrial parks and able to specify the criteria of success for building eco-industrial parks.

Contents:

Material and energy flows in economic systems and their environmental impacts. Physical, biological and societal framework of industrial ecology. Industrial metabolism, corporate industrial ecology, eco-efficiency, dematerialization. Tools of industrial ecology, such as life-cycle assessment, design for the environment, green chemistry and engineering. Systems-level industrial ecology, industrial symbioses, eco-industrial parks.

Mode of delivery:

Face-to-face teaching in English.

Learning activities and teaching methods:

Lectures 30 h / Group work 20 h / Self-study 83 h. The exercises are completred as group work

Target group:

Master's degree students of process and environmental engineering.

Prerequisites and co-requisites:

-

Recommended optional programme components:

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Recommended or required reading:

Lecture notes; Graedel T.E & Allenby B.R.: Industrial Ecology. New Jersey: Prentice Hall, 2003.

Assessment methods and criteria:

All students complete the course in a final exam. Also the exercise will be assessed. The assessment criteria are based on the learning outcomes of the course.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Virpi Väisänen

Working life cooperation:

No

Other information:

-

488133A: Environmental Impact Assessment, 5 op

Voimassaolo: 01.08.2015 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488103A	Environmental Impact Assessment	4.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given in the autumn semester, during period 1

Learning outcomes:

The student will acquire a broad and multidisciplinary and sustainable approach to environmental impact assessment (EIA). The student will know the all steps in EIA process and the different methods used in environmental impact assessment. During the course students develop their working life skills (e.g. writing, communication and presentation skills) and the ability to review environmental problems. Thy also learn how to resolve extensive environmental projects related problems, causes and consequences.

Contents:

EIA process and legislation, environmental change, principles and assessment methods in ecology, hydrology, economics and social sciences

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

The course contains lectures (20 h), seminars (9 h) and independent works (106 h)

Target group:

Master students in the Environmental Engineering study program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering I (477011P) and II (488010P)

Recommended optional programme components:

-

Recommended or required reading:

Environmental Impact Assessment: Cutting Edge for the Twenty-First Century (Gilpin A, 1995, ISBN 0-521-42967-6). Lecture hand-outs and other materials delivered in lectures.

Assessment methods and criteria:

The assignement (60 %) and seminar (40%). More information about assessment methods of each module is given during the course.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

The course is arranged in alternate years (even autumn semesters). The course is organised in a co-operation with the Faculty of Technology and the Thule Institute.

477715S: Environmental and Social Responsibility in Mining, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jaakko Rämö

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Organized resources allowing

Learning outcomes:

After completion of this course the student is able to develop, pply and assess the targets, practices and methods of environmentally and socially responsible mining in practice

Contents:

Environmentally and socially responsible mining

Mode of delivery:

Implemented as distance learning

Learning activities and teaching methods:

Lectures and exercises by distance learning and learning diaries

Target group:

The students of the Mineral Processing study option in the study programmes Process Engineering or Environmental Engineering, etc. and the students of Luleå University of Technology (LTU) within the Nordic Mining School (NMS) agreement between LTU and the University of Oulu

Prerequisites and co-requisites:

The Bachelor level studies of the process or environmental engineering study programmes or respective knowledge, and the preceding Master level studies or respective knowledge

Recommended optional programme components:

The other courses of the Master's phase curriculum

Recommended or required reading:

Lectures and articles delivered during lectures

Assessment methods and criteria:

Active participation to the lectures and a learning diary.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Prof. Rauno Sairinen (University of Eastern Finland) or NN, Nordic Mining School Coordinator Jaakko Rämö (Thule Institute, University of Oulu)

Working life cooperation:

No

Other information:

This course is organized within the Nordic Mining School (NMS) agreement between Luleå University of Technology, Sweden and the University of Oulu

A432233: Module of the Option/Industrial Energy and Environmental Engineering, 60 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

477223S: Advanced Process Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477206S	Advanced Process Design	6.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Spring, period 4

Learning outcomes:

The student is able to produce a preliminary chemical process concept. She/he can apply systematic process synthesis tools, chemical process simulation tools and whole process performance criteria in the conceptual process design phase. Furthermore, the student is able to produce process design documents. The student will acquire skills how to work as a member in an industrial chemical process design project. She/he will experience by team work the hierarchical character of the conceptual process design, the benefits of the systematic working methods and the need to understand the whole process performance when optimal design is sought. The student understands the importance of innovation and creative work.

Contents:

Conceptual process design and hierarchical decision making. Heuristics of process design. Design methodology: synthesis, analysis and evaluation. Design cycle. Performance evaluation of the chemical processes. Team work and meetings.

Mode of delivery:

Design projects in small groups

Learning activities and teaching methods:

Project meetings 10h and project group work 120h

Target group:

Master's students of process and environmental engineering

Prerequisites and co-requisites:

Learning outcomes of 477203A Process Design or similar knowledge

Recommended optional programme components:

Part of Process Design Module

Recommended or required reading:

Seider, W.D., Seider, J.D. and Lewin, D.R. Product and process design principles: Synthesis, analysis and evaluation. John Wiley & Sons, 2004. (Parts) ISBN 0-471-21663-1

Assessment methods and criteria:

Project work with oral and written reporting. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

No

Other information:

-

477224S: Biorefineries, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Period 2 (autumn term)

Learning outcomes:

By completing the course the student understands the state-of-the-art technology level of the processing of biofuels, biochemicals and energy from lignocellulosic biomass. She/he can conclude technological and economical challenges facing the development work of biorefineries. She/he is able to apply performance criteria considering sustainable development.

Contents:

Historical background. Fossil and biomass raw material resources for energy production. Production of transportation fuels. Technology generations. Biorefineries and their categorisation. Lignocellulosic biorefineries. Production of biochemicals. Development phase of biorefineries: technical, economical and environmental considerations. Commercialisation state of nonwood biorefineries.

Mode of delivery:

Lectures and small group exercises. Occurring every two years.

Learning activities and teaching methods:

Lectures 30 h and self-study 100 h

Target group:

Master's students in the study options chemical engineering and bioprocess engineering

Prerequisites and co-requisites:

To understand the phenomena and operations present in processes, 488052A Introduction to Bioproduct and Bioprocess Engineering.

Recommended optional programme components:

-

Recommended or required reading:

Lecture handouts

Assessment methods and criteria:

Examination and other evaluation methods

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Juha Tanskanen

Working life cooperation:

No

Other information:

-

477309S: Process and Environmental Catalysis, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

470226S	Catalytic Processes	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester, during 1 st period. It is recommended to complete the course at the fourth (1 st Master's) autumn semester.

Learning outcomes:

After the course the student is able to define the fundamentals and history of catalysis and he/she can explain the economical and environmental meaning of catalysis. The student is capable of specifying the design, selection and testing of catalysts and catalytic reactors and processes.
He/she is able to explain the most important industrial catalytic processes, the use of catalysts in environmental technology, catalyst research and the significance of an interdisciplinary approach in the preparation, development and use of catalysts. He/she recognizes the connection between catalysis and green chemistry and the role of catalysis in sustainable processes and energy production.

Contents:

Definition of catalysis and a catalyst, history of catalysis, economical, social and environmental meaning. Preparation of catalysts, principles, selection, design and testing of catalysts and catalytic reactors. Kinetics and mechanisms of catalytic reactions, catalyst deactivation. Industrially important catalysts, catalytic reactors and catalytic processes. Environmental catalysis. Catalysts in air pollution control and purification of waters. Catalysis and green chemistry. Catalysis for sustainability. Principles in the design of catalytic processes.

Mode of delivery:

Lectures including design exercises, face-to-face teaching.

Learning activities and teaching methods:

Lectures 40 h, exercises 10 h, homework 30 h, self-study 53 h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I, 488010P Introduction to Process and Environmental Engineering II, and 780109P Basic Principles in Chemistry are recommended beforehand.

Recommended optional programme components:

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Recommended or required reading:

Lecture handout; Richardson, J.T.: Principles of Catalyst Development. New York. 1989, 288 pp.; Janssen, F.J.J.G. & van Santen, R.A.: Environmental Catalysis. NIOK, Catalytic Science Series, Vol. 1. 1999. 369 pp. *Additional literature:* Ertl, G., Knözinger, J. & Weitkamp, J.: Handbook of Heterogeneous Catalysis. Vol. 1-5. Weinheim. 1997, 657 p.; Thomas, J.M. & Thomas, W.J.: Principles and Practice of Heterogenous Catalysis. Weinheim 1997. 657 pp.; Somorjai, G.A.: Surface Chemistry and Catalysis. New York 1994, 667 pp.; van Santen, R.A., van Leuwen, P.W.N.M., Mouljin, J.A. & Averill, B.A.: Catalysis: An Integrated Approach, 2nd ed. Studies in Surface Science and Catalysis 123. Amsterdam 1999, Elsevier Sci. B.V. 582 pp.

Assessment methods and criteria:

Written examination and homework.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Post-doctoral research fellow Tanja Kolli

Working life cooperation:

No

Other information:

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488133A: Environmental Impact Assessment, 5 op

Voimassaolo: 01.08.2015 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488103A	Environmental Impact Assessment	4.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given in the autumn semester, during period 1

Learning outcomes:

The student will acquire a broad and multidisciplinary and sustainable approach to environmental impact assessment (EIA). The student will know the all steps in EIA process and the different methods used in environmental impact assessment. During the course students develop their working life skills (e.g. writing, communication and presentation skills) and the ability to review environmental problems. Thy also learn how to resolve extensive environmental projects related problems, causes and consequences.

Contents:

EIA process and legislation, environmental change, principles and assessment methods in ecology, hydrology, economics and social sciences

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

The course contains lectures (20 h), seminars (9 h) and independent works (106 h)

Target group:

Master students in the Environmental Engineering study program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering I (477011P) and II (488010P)

Recommended optional programme components:

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Recommended or required reading:

Environmental Impact Assessment: Cutting Edge for the Twenty-First Century (Gilpin A, 1995, ISBN 0-521-42967-6). Lecture hand-outs and other materials delivered in lectures.

Assessment methods and criteria:

The assignement (60 %) and seminar (40%). More information about assessment methods of each module is given during the course.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

The course is arranged in alternate years (even autumn semesters). The course is organised in a co-operation with the Faculty of Technology and the Thule Institute.

488104A: Industrial and municipal waste management, 5 op

Voimassaolo: 01.08.2005 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisangela Heiderscheidt

Opintokohteen kielet: English

Leikkaavuudet:

480160S	Waste Management of Communities and Industry	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is organized in the autumn semester, during period 1

Learning outcomes:

The student will acquire a wilder view of what is waste and how it is generated and managed in communities and industries. Student will be familiar with waste management hierarchy and how waste legislation regulates waste management. She/he will get basic knowledge about waste treatment methods including their sustainability and related environmental impacts. As well as, how a series of factors influence the planning of waste management activities in industries and municipalities. The student will also be able to understand the energy and material recovery potential within the waste sector.

Contents:

Waste management hierarch, waste prevention principle, municipal waste management, waste management in industries, waste legislation, municipal and industrial waste treatment methods, international treaties related to waste management, waste to energy principle.

Mode of delivery:

Face-to-face teaching and guided assignments.

Learning activities and teaching methods:

Learning methods: A) Active learning method: Lectures (25 h), group work/ exercises (45 h), self-study for examination and completion of exercises (55 h) and field visits (8 h) or alternatively; B) BOOK examination: 100% self-study mode where the student is provided with 2-3 books as reference material and he/she attends an examination.

Target group:

Students in the Bachelor program of Environmental Engineering

Prerequisites and co-requisites:

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Recommended optional programme components:

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Recommended or required reading:

Lecture hand-outs, notes and other materials delivered in lectures; Waste management: a reference handbook illustrated edition, 2008 (electronic book, ISBN 9781598841510); Pippo, S., 2013. Municipal solid waste management in Finland. Greensettle publications. ISBN 978-952-62-0071-2.

Assessment methods and criteria:

A) Active mode: *successful completion of course work which consists of* group exercises 1 and 2 and achieving a pass grade (1-5) in the final exam which is based on lectures material and exercises; B) Self-study mode: achieving a passing grade (1-5) in the exam which is based on provided reference material. Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Researcher Elisangela Heiderscheidt

Working life cooperation:

No

Other information:

-

488110S: Water and Wastewater Treatment, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisangela Heiderscheidt

Opintokohteen kielet: English

Leikkaavuudet:

480151S	Water and Wastewater Treatment	7.0 op
480208S	Industrial Water and Wastewater Treatment	3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, during period 1

Learning outcomes:

Upon completion of the course, the student will be able to understand the theory and practicalities of the most used processes in water and wastewater treatment. The student will also be capable to perform basic dimensioning calculations and therefore he/she will be able to dimension structures/units of water and wastewater treatment plant processes.

Contents:

Water quality characteristics of source water; basic principles of purification processes (coagulation/flocculation, sedimentation, biological treatment, filtration, disinfection, etc.); used process units in water and waste water treatment; selection of process units; dimensioning of treatment units and unit processes..

Mode of delivery:

Mix of guided self-study work and face-to-face teaching and field visits

Learning activities and teaching methods:

Lectures (20 h), field visits (5 h), exercises ( ), self-study (60 h)

Target group:

Students in the Master program of Environmental Engineering

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering I (477011P) and II (488010P)

Recommended optional programme components:

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Recommended or required reading:

Lecture hand-outs, & “Lindquist, A., 2003. About water treatment. Helsingborg: Kemira Kemwater”. Optional: RIL 124-2, Vesihuolto II; Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse; AWWA, Water quality & treatment; AWWA, Water treatment plant design.

Assessment methods and criteria:

The course can be completed: A) Active mode: midterm exam based on reading material + completion of 2 group exercises + final exam based on lectures and exercises; B) BOOK exam: 100% self-study mode where the student is provided with 2-3 reference books and attends an exam based on the provided material.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Researcher Elisangela Heiderscheidt

Working life cooperation:

No

Other information:

-

488202S: Production and Use of Energy, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

488208A	Basics of production and use of energy	5.0 op
470057S	The Energy Economy of Industrial Establishments	3.5 op

ECTS Credits:

5 ECTS credits / 133 hours of work.

Language of instruction:

English

Timing:

Implementation in autumn semester during 1 st period. It is recommended to complete the course at fourth (1 st Master's) autumn semester.

Learning outcomes:

The student is able to define different methods and techniques to generate electricity and heat. He/she is able to explain steam power plant operating principles and is able to compare operation of different kinds of steam power plants. The student can describe the environmental impacts of energy production and is able to compare the environmental impacts of different ways of producing energy. The student is able to identify functioning of the fossil based and renewable energy production systems. He/she is able to explain how the electricity markets work. The student is also able to explain the adequacy of energy reserves.

Contents:

Structure of energy production and consumption. Systems for electric transportation, storing and distribution. Distribution and adequacy of energy resources. Effects of environment contracts on the use of energy resources. Environmental comparison of different energy production methods and fuels. Energy markets. Development views of energy technology.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40h, self-study 93 h.

Target group:

Master's degree students of Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P and 488010P Introduction to Process and Environmental Engineering I and II are recommended.

Recommended optional programme components:

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Recommended or required reading:

Materials delivered via the Optima environment.

Assessment methods and criteria:

Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Mika Huuhtanen

Working life cooperation:

No

Other information:

-

488203S: Industrial Ecology, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Väisänen, Virpi Maria

Opintokohteen kielet: English

Leikkaavuudet:

ay488203S	Industrial Ecology and Recycling	5.0 op
480370S	Industrial Ecology and Recycling	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 th period.

Learning outcomes:

Upon completion of the course, the student will be able to use the tools of industrial ecology and apply them to industrial activity. The student can also analyze the interaction of industrial, natural and socio-economic systems and able to judiciously suggest changes to industrial practice in order to prevent negative impacts. The student can also analyze the examples of industrial symbioses and eco-industrial parks and able to specify the criteria of success for building eco-industrial parks.

Contents:

Material and energy flows in economic systems and their environmental impacts. Physical, biological and societal framework of industrial ecology. Industrial metabolism, corporate industrial ecology, eco-efficiency, dematerialization. Tools of industrial ecology, such as life-cycle assessment, design for the environment, green chemistry and engineering. Systems-level industrial ecology, industrial symbioses, eco-industrial parks.

Mode of delivery:

Face-to-face teaching in English.

Learning activities and teaching methods:

Lectures 30 h / Group work 20 h / Self-study 83 h. The exercises are completred as group work

Target group:

Master's degree students of process and environmental engineering.

Prerequisites and co-requisites:

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Recommended optional programme components:

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Recommended or required reading:

Lecture notes; Graedel T.E & Allenby B.R.: Industrial Ecology. New Jersey: Prentice Hall, 2003.

Assessment methods and criteria:

All students complete the course in a final exam. Also the exercise will be assessed. The assessment criteria are based on the learning outcomes of the course.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Virpi Väisänen

Working life cooperation:

No

Other information:

-

488204S: Air Pollution Control Engineering, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Satu Pitkäaho

Opintokohteen kielet: English

Leikkaavuudet:

ay488204S	Air Pollution Control Engineering (OPEN UNI)	5.0 op
488213A	Sources and control of air pollution	5.0 op
480380S	Air Protection Techniques	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 nd period.

Learning outcomes:

The student is able to explain what kind of air emissions originate from certain industries and power plants, and can explain their environmental and health impacts. The student is able to explain the common air pollution control systems for different emissions (SO2, NOx, VOC, CO2, dust) and is able to design air pollution cleaning devices. He/she can describe how air emissions are measured. In addition, the student is able to describe the main laws related to air emission control.

Contents:

Effects of pollution on the atmosphere. Acid rain. Climate change. Ozone. Effects of pollution on health, nature and buildings. Legislation. Measurement of emissions. Emission control technologies, VOC emissions, SO_x emissions, NO_X emissions, heavy metals, POPs, HAPs, etc.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30h, exercises 10h and self-study 93 h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I, 488011P Introduction to Process and Environmental Engineering II and 780109P Basic Principles in Chemistry recommended beforehand.

Recommended optional programme components:

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Recommended or required reading:

Materials in the Optima environment. de Nevers; N.: Air Pollution Control Engineering. 2nd ed. McCraw-Hill 2000. 586 pp
Additional literature: Singh, H. B.: Composition, Chemistry, and Climate of the Atmosphere. New York 1995. 527 pp.; Bretschneider, B. & Kurfurst, J.: Air Pollution Control Technology. Elsevier, Amsterdam 1987. 296 pp.; Hester, R. E. & Harrison, R. M.: Volatile Organic Compound in the Atmosphere. Issues in Environmental Science and Technology. Vol. 4. Bath 1995; Hester, R. E. & Harrison, R. M.: Waste Incineration and the Environment. Issues in Environmental Science and Technology. Vol 4. Bath 1995.

Assessment methods and criteria:

Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University researcher Satu Ojala

Working life cooperation:

No

Other information:

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488221S: Environmental Load of Industry, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Niina Koivikko

Opintokohteen kielet: English

Leikkaavuudet:

488215S	Industry and Environment	5.0 op
488205S	Environmental Load of Process Industry	4.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during 3 rd period.

Learning outcomes:

The student is able to identify the essential features of the environmental load in different types of (chemical, wood, metallurgical, etc.) industry. He/she is able to explain the type, quality, quantity and sources of the emissions. The student is familiarized with the main emission control systems and techniques in different industrial sectors. He/she has the skills to apply BAT-techniques in emission control. The student can explain the environmental management system of an industrial plant and is able to apply it to an industrial plant.

Contents:

Effluents: types, quality, quantity, sources. Unit operations in managing effluents, comprehensive effluent treatment. Environmental management systems, environmental licences, environmental reporting and BAT.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 40 h, self-study 93h.

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

The courses 477011P Introduction to Process and Environmental Engineering I, 488011P Introduction to Process and Environmental Engineering II, 488204S Air Pollution Control Engineering and 488110S Water and Wastewater Treatment recommended before-hand.

Recommended optional programme components:

-

Recommended or required reading:

Material represented in lectures and in the Optima environment.

Assessment methods and criteria:

Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:

University researcher Satu Ojala

Working life cooperation:

No

Other information:

Expert lecturers may be invited from industry to give specific lectures related to the organization.

488206S: Sustainable Energy Project, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

488410A	Introduction to Sustainable Energy	10.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during3 th and 4 th periods

Learning outcomes:

The student is able to adapt the (skills) tools learned in previous courses to complete an energy production and management design project. The student will solve an engineering problem related to sustainable energy generation in cold climate.The student is able to describe the key practical issues related to sustainable energy generation. The student will evaluate the relevant instruments, tools and measures required for sustainable energy production, distribution, and end-use efficiency. The student will demonstrate the ability to select the proper tools, and methods to solve the design problem. The student will also acquire skills to work as a member in an engineering design project as part of a team. He/she will gain the experience to carry out a real project and produce a documentation of the engineering solution.

Contents:

A design project to adapt small-scale renewable energy production and management, greenhouse gas reduction and/or utilization, wind, solar, and geothermal energy generation. Management of energy efficiency. Energy engineering and design principles. Performance evaluation and sustainability assessment of the selected project. Problem solving.

Mode of delivery:

Team work, group meetings and seminars

Learning activities and teaching methods:

Lectures, design projects in small groups, presentations and reporting.

Target group:

Master's degree students of the degree programmes of Process Engineering and Environmental Engineering

Prerequisites and co-requisites:

The course 488202 Production and Use of Energy is a compulsory, and 488203S Industrial Ecology and 477309S Process and Environmental Catalysis courses are recommended prerequisites to the project

Recommended optional programme components:

-

Recommended or required reading:

Materials delivered on lectures and during the group meetings. *Additional literature:* Manuals and databases, depends on the project work selected.

Assessment methods and criteria:

Written report with the documentation of the engineering solution.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Mika Huuhtanen

Working life cooperation:

No

Other information:

-

477307S: Research Methodology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

480311S	Research Methodology	3.5 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

English

Timing:

Implementation in autumn and spring semesters during periods 1-4.

Learning outcomes:

After the course the student is able to define the role of research and different stages of research work. The student is also able to classify the stages and the subtasks of research work as well as important elements related to research, i.e. literature search, experimental work, and data processing. In addition, the student can evaluate the amount of work needed in research stages. The student can write scientific text and use references appropriately. The student also has the ability to recognise ethical issues related to research and analyse the meanings of those. He/she can use the principles of good scientific practises and is able to apply knowledge to research work.

Contents:

1) Science and research politics. 2) Research education. 3) Fundamentals of philosophy of science. 4) Starting research work: research types, funding, the process of research work, finding the research area, choosing the research topic, information sources. 5) Research plan and collecting data, experimental methods and significance of the variables, systematic experimental design, collecting experimental data, test equipment, reliability of the results, problems in laboratory experiments, modelling and simulation. 6) Mathematical analysis of results. 7) Reporting: writing a scientific text, referring, writing diploma, licentiate and doctoral theses, or reports. 8) Other issues connected to research work: ethical issues, integrity, and future. 9) Examples of scientific research in practice.

Mode of delivery:

Miniproject based on lectures in Optima during autumn term, contact lectures, laboratory training period during spring term.

Learning activities and teaching methods:

Contact lectures 6 h, miniproject 15 h, training period 70 h, self-study 42 h.

Target group:

Master’s degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

None

Recommended optional programme components:

-

Recommended or required reading:

Melville, S & Goddard, W: Research Methodology; An Introduction for Science and Engineering Students. Kenwyn 1996, Juta & Co. Ltd. 167 p. Hirsijärvi, S., Remes, P. & Sajavaara, P.: Tutki ja kirjoita. Jyväskylä 2004, GummerusKirjapaino Oy. 436 p. Material introduced in the lectures.
Additional literature : Paradis, J.G. & Zimmermann, M.L.: The MIT Guide to Science and Engineering Communication, 2nd ed. Cambridge 2002, The MITPress, 324 p. Nykänen, O.: Toimivaa tekstiä, Opas tekniikasta kirjoittaville. Helsinki 2002, Tekniikan Akateemisten Liitto TEK. 212 p.

Assessment methods and criteria:

Optima exercises (miniproject) and laboratory training.
Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Mika Huuhtanen

Working life cooperation:

No

Other information:

The objective of the course is to familiarise the student with scientific research, scientific methods and data handling, especially in process and environmental engineering. The course will give the student the basis to do the research work and motivates him/her to begin post-graduate studies. The course gives the student team working skills and increases the co-operation between the students and the research and teaching staff. The students are exposed to experiences in co-operation between different fields of science, industry, and other universities and laboratories, as well as the skills for doctoral studies.

A432234: Module of the Option/Industrial Engineering, 60 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

555286A: Process and quality management, 5 op

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Osmo Kauppila

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay555286A	Process and quality management (OPEN UNI)	5.0 op
555281A	Basic Course of Quality Management	5.0 op

ECTS Credits:

5 ECTS credits.

Language of instruction:

Finnish.

Timing:

Period 4.

Learning outcomes:

Upon completion the student is able to explain the role of process and quality management in a business organization. The student is capable of developing business processes based on the principles of quality management and appropriate tools.

Contents:

Foundations of total quality management, planning of quality, performance measurement, process management, people management in relation to quality management, implantation of total quality management.

Mode of delivery:

The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:

20 h lectures, 114 h independent study including tutored group work.

Target group:

Industrial Engineering and Management students and other students studying Industrial Engineering and Management as minor.

Prerequisites and co-requisites:

-

Recommended optional programme components:

This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555285A Project management, 555242A Product development, and 555264P Managing well-being and quality of working life.

Recommended or required reading:

Oakland, J.S. (2014) Total quality management and operational excellence (4th ed.). Routledge, 529 pp. and material handed out during the course.

Assessment methods and criteria:

To pass the course, the student must pass the course exam and complete the classroom exercises and the group work. The course grade is calculated based on the exam and group work grades.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Osmo Kauppila.

Working life cooperation:

No.

Other information:

Substitutes course 555281A Basic Course of Quality Management.

555390S: Statistical Process Management, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Osmo Kauppila

Opintokohteen kielet: Finnish

Leikkaavuudet:

555380S	Quality Management	5.0 op

ECTS Credits:

5 ECTS credits.

Language of instruction:

Finnish.

Timing:

Period 1.

Learning outcomes:

Upon completion the student can analyze and improve the processes of an organization with the help of statistical tools. The student is able to disseminate the applicability of various statistical tools and methods in different kinds of organizational environments.

Contents:

Processes in an organization from a statistical viewpoint, tools and methods of statistical process control, process improvement using numeric data, stages, challenges and implementation of data analysis, the role of statistical methods in various management philosophies.

Mode of delivery:

The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:

28 h lectures, 105 h independent study on course exercises.

Target group:

Industrial Engineering and Management students and other students studying taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:

555286A Process and Quality Management

Recommended optional programme components:

-

Recommended or required reading:

The study materials will be announced at the beginning of the course.

Assessment methods and criteria:

To pass the course, the student must complete the course exercises and an accompanying course assignment. The course grade is calculated based on the grades of these two course components.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Osmo Kauppila.

Working life cooperation:

No.

Other information:

Substitutes course 555380S Quality Management.

555389S: Systematic Process Improvement, 10 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Osmo Kauppila
Opintokohteen kielet: Finnish

ECTS Credits:

10 ECTS credits.

Language of instruction:

Finnish

Timing:

Periods 1 - 2

Learning outcomes:

Upon completion the student can manage the improvement and problem solving in a process using quality management tools. The student can explain the steps of the DMAIC problem solving model and apply the correct tools for each step. The student is able to apply quality tools into real life process data with the help of MINITAB software and to analyse the results. The student increases his/her understanding of the process type studied in the course exercise.

Contents:

Problem solving using DMAIC, the Six Sigma body of knowledge quality tools, use of MINITAB software, process improvement in practice.

Mode of delivery:

The tuition will be implemented as blended teaching.

Learning activities and teaching methods:

Lectures and related exercises, site visit, a large group exercise related to a process operating in practice.

Target group:

Industrial Engineering and Management students, other students taking Industrial Engineering and Management as minor, postgraduate students.

Prerequisites and co-requisites:

Bachelor in Industrial Engineering and Management or equivalent. Basic knowledge of statistical process control.

Recommended optional programme components:

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Recommended or required reading:

Kubiak, TM & Benbow DW (2009) The Certified Six Sigma Black Belt Handbook, Second Edition. ASQ Quality Press, Milwaukee. 620 s. and material handed out during the course.

Assessment methods and criteria:

To pass the course, the student must complete the group work as an active team member, take part in the course lectures and return the related exercises.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Osmo Kauppila.

Working life cooperation:

-

Other information:

-

Choose 2 courses

555285A: Project management, 5 op

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Kirsi Aaltonen

Opintokohteen kielet: Finnish

Leikkaavuudet:

555288A	Project Management	5.0 op
ay555285A	Project management (OPEN UNI)	5.0 op
555282A	Project Management	4.0 op
555280P	Basic Course of Project Management	2.0 op

ECTS Credits:

5 ECTS credits.

Language of instruction:

Finnish. English material may also be used.

Timing:

Period 1.

Learning outcomes:

The objective of the course is to familiarise the student with the basics and the basic methods of project management. Upon completion the student can explain the essential concepts related to project management. He/she can present the main features of a project plan and can use different methods of partitioning a project. The student can also schedule a project and estimate its costs. The student can explain the terms related to Earned value method and can apply the method on simple tasks. Upon completion the student recognizes the essential tasks of project risk management.

Contents:

Defining project management, project planning, organising and scope management, schedule management, cost management, earned value calculation and project risk management, project stakeholder management.

Mode of delivery:

The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:

Lectures or web-based lectures 16h, self-study 118h

Target group:

Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:

No prerequisites exist.

Recommended optional programme components:

This course is part of the 25 ECTS module of Industrial engineering and management that also includes555225P Basics of industrial engineering and management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

Recommended or required reading:

Lecture material, exercise book, Artto, Martinsuo & Kujala 2006. Projektiliiketoiminta. WSOY

Assessment methods and criteria:

The course includes three mandatory assignments, exercise book and exam. The course grading is based on the exam. Well completed assignments and exercise book may raise grading.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Jaakko Kujala.

Working life cooperation:

No.

Other information:

Substitutes courses 555280P Basic Course of Project Management + 555282A Project Management.

555242A: Product development, 5 op

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Haapasalo, Harri Jouni Olavi

Opintokohteen kielet: English

Leikkaavuudet:

ay555242A	Product development (OPEN UNI)	5.0 op
555240A	Basic Course in Product Development	3.0 op

ECTS Credits:

5 ECTS credits**.**

Language of instruction:

English.

Timing:

Period 1.

Learning outcomes:

This course introduces product development and innovations management in a company environment. The course provides fundamental understanding over tools and frameworks that can be used for analysing and managing products, innovations, and technology development. The aim is to create a connection between product development and other company functions. Upon completion of the course a student is capable of explaining the role of product development as a company function. The student understands the difference between innovation activities and systematic product development, and knows the difference between different phases of product development process and its activities. Student learns how to transform customer needs into requirements for product development process and finally into product features. Additionally, the student is able to define the meaning of other company functions to product development activities.

Contents:

Meaning of products for the operations of an industrial enterprise, product development paradigm and defining relevant concepts, realising product development methodologically (U&E model, Cooper's stage-gate model, QFD), managing innovations, and product development success factors.

Mode of delivery:

The tuition will be implemented as blended teaching.

Learning activities and teaching methods:

Lectures 20 h / exercises 6 h / group work and self-study 108 h.

Target group:

Industrial Engineering and Management students and other students taking Industrial Engineering and Management as minor.

Prerequisites and co-requisites:

555226A Operations and production.

Recommended optional programme components:

This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555285A Project management, 555264P Managing well-being and quality of working life, and 555286A Process and quality management..

Recommended or required reading:

Handouts, course work, and a collection of articles. Ulrich, K. & Eppinger, S. (2008) Product Design and Development. McGraw-Hill. 358 p.

Assessment methods and criteria:

Assignment and final exam.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail..

Person responsible:

Professor Harri Haapasalo.

Working life cooperation:

No.

Other information:

Substitutes course 555240A Basic Course in Product Development.

555226A: Operations and Production, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Industrial Engineering and Management
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Majava
Opintokohteen kielet: English
Leikkaavuudet:

555222A	Demonstration in Industrial Engineering and Management	2.0 op
555223A	Introduction to Production Control	3.0 op

ECTS Credits:

5 ECTS credits

Language of instruction:

English.

Timing:

Periods 1-2.

Learning outcomes:

Upon completion of the course the student should be able to describe different production types. He/she can apply different forecasting methods, plan needed production capacity, and apply location and transportation decisions related methods. The student can master common inventory management methods and aggregated and short-term scheduling. The student can also create a sales and operations plan for a company.

Contents:

Production types, forecasting methods, capacity planning and queuing models, location and transportation decisions, inventory management systems, aggregate scheduling, MRP & ERP, short-term scheduling, linear programming.

Mode of delivery:

The tuition will be implemented as blended teaching (web-based teaching and face-to-face teaching).

Learning activities and teaching methods:

Lectures 20 h / self-study (web-based exercises) 60 h / group work 54 h.

Target group:

Industrial Engineering and Management and Master’s Programme in Product Management students.

Prerequisites and co-requisites:

555225P Basics of industrial engineering and management or similar knowledge.

Recommended optional programme components:

Industrial Engineering and Management students will complete 902143Y English course simultaneously.

Recommended or required reading:

Lecture and exercise materials. Heizer, J. & Render, B. (2014) Operations management: sustainability and supply chain management, 11th ed. Pearson. Krajewski, L.J. et al. (2012) Operations management: processes and supply chains, 10th ed. Pearson.

Assessment methods and criteria:

This course utilizes continuous assessment. During the course, there are mandatory weekly assignments. At least half of the assignments must be passed. 40 % of the grade is based on the group work.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

D.Sc. Jukka Majava.

Working life cooperation:

No.

Other information:

Substitutes course 555222A Demonstration in Industrial Engineering and Management 2 ECTS cr and 555223A Introduction to Production Control 3 ECTS cr.

A432235: Module of the Option/Water and Geo Engineering, 60 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory, choose also 20 ECTS from one of the electives

488133A: Environmental Impact Assessment, 5 op

Voimassaolo: 01.08.2015 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488103A	Environmental Impact Assessment	4.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given in the autumn semester, during period 1

Learning outcomes:

The student will acquire a broad and multidisciplinary and sustainable approach to environmental impact assessment (EIA). The student will know the all steps in EIA process and the different methods used in environmental impact assessment. During the course students develop their working life skills (e.g. writing, communication and presentation skills) and the ability to review environmental problems. Thy also learn how to resolve extensive environmental projects related problems, causes and consequences.

Contents:

EIA process and legislation, environmental change, principles and assessment methods in ecology, hydrology, economics and social sciences

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

The course contains lectures (20 h), seminars (9 h) and independent works (106 h)

Target group:

Master students in the Environmental Engineering study program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering I (477011P) and II (488010P)

Recommended optional programme components:

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Recommended or required reading:

Environmental Impact Assessment: Cutting Edge for the Twenty-First Century (Gilpin A, 1995, ISBN 0-521-42967-6). Lecture hand-outs and other materials delivered in lectures.

Assessment methods and criteria:

The assignement (60 %) and seminar (40%). More information about assessment methods of each module is given during the course.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

The course is arranged in alternate years (even autumn semesters). The course is organised in a co-operation with the Faculty of Technology and the Thule Institute.

488110S: Water and Wastewater Treatment, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisangela Heiderscheidt

Opintokohteen kielet: English

Leikkaavuudet:

480151S	Water and Wastewater Treatment	7.0 op
480208S	Industrial Water and Wastewater Treatment	3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, during period 1

Learning outcomes:

Upon completion of the course, the student will be able to understand the theory and practicalities of the most used processes in water and wastewater treatment. The student will also be capable to perform basic dimensioning calculations and therefore he/she will be able to dimension structures/units of water and wastewater treatment plant processes.

Contents:

Water quality characteristics of source water; basic principles of purification processes (coagulation/flocculation, sedimentation, biological treatment, filtration, disinfection, etc.); used process units in water and waste water treatment; selection of process units; dimensioning of treatment units and unit processes..

Mode of delivery:

Mix of guided self-study work and face-to-face teaching and field visits

Learning activities and teaching methods:

Lectures (20 h), field visits (5 h), exercises ( ), self-study (60 h)

Target group:

Students in the Master program of Environmental Engineering

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering I (477011P) and II (488010P)

Recommended optional programme components:

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Recommended or required reading:

Lecture hand-outs, & “Lindquist, A., 2003. About water treatment. Helsingborg: Kemira Kemwater”.
Optional: RIL 124-2, Vesihuolto II; Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse; AWWA, Water quality & treatment; AWWA, Water treatment plant design.

Assessment methods and criteria:

The course can be completed: A) Active mode: midterm exam based on reading material + completion of 2 group exercises + final exam based on lectures and exercises; B) BOOK exam: 100% self-study mode where the student is provided with 2-3 reference books and attends an exam based on the provided material.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Researcher Elisangela Heiderscheidt

Working life cooperation:

No

Other information:

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488108S: Groundwater Engineering, 5 op

Voimassaolo: - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Björn Klöve

Opintokohteen kielet: English

Leikkaavuudet:

480122A Groundwater Technology 5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the spring semester, during period 4

Learning outcomes:

Upon completion of the course, the student will have knowledge on water retention and flow in soils, basic theories about hydraulics of groundwater systems, groundwater quality, groundwater use and modelling. Students learn to define hydraulic characteristics of soil and aquifers. After the course students are able to estimate key factors influencing on discharge and water quality of groundwater and to use general methods to calculate groundwater flow. They also know how to plan, manage, and protect groundwater resources in a sustainable way.

Contents:

Soil and groundwater, water balance, hydraulic properties of soils, formation of groundwater, flow equations and solutions, pumping tests and methods, groundwater quality and modelling.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 10 h, calculus exercises 9 h, MODFLOW modelling exercises 16 h, modelling report 40 h, and self-study 60 h

Target group:

Master students in the Water Engineering study options of the Environmental Engineering program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes

Recommended optional programme components:

-

Recommended or required reading:

Lecture handouts, Physical and Chemical Hydrogeology (Domenico PA, Schwartz FW, 2nd edition, 1998, ISBN 0-471- 59762-7). Maanalaiset vedet - pohjavesigeologi-an perusteet (Korkka-Niemi K, Salonen V-P, 1996, ISBN 951-29-0825-5). Pohjavesi ja pohjaveden ympäristö (Mälkki E, 1999, ISBN 951-26-4515-7).

Assessment methods and criteria:

Modelling assignment (40 % of the grade) and exam (60 % of the grade).
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Postdoctoral Researcher Pekka Rossi

Working life cooperation:

No

Other information:

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488127S: Field measurements, site investigations and geotechnical tests, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given during periods 1 and 2

Learning outcomes:

Upon completion the student should be able to design field measurements and understand the quality of sampling and measurements in the field of environmental engineering. The student also improves skills of working in a team of fellow students to share expertise and execution responsibilities. The student understands the laboratory testing procedures and the associated parameters that help in estimating the soil mechanics and Geotechnical engineering and. The student knows how to use different methods for field measurement and sampling in water and geotechnical issues. The student can take considering the safety during the laboratory works and field measurements. After the course, the student can write detailed engineering reports.

Contents:

In the lectures: Units of measurements, Error and mistake in laboratory works and field measurements, random and systematic error, precision and accuracy in laboratory work, planning field works, description of measuring site, Securing results and material, sample preservation, subsoil exploration, direct & indirect methods of exploration, disturb and undisturbed samples, Safety in field work, introduction on surveying, leveling, map and scale.
In laboratory: Laboratory works on Geotechnical and Geoenvironmental Engineering contain sieving test, hydrometer test, Atterberg limits test, proctor test, direct shear box test and eudiometer test. Field measurement experiences in cold climate.
In the field: Working with GPS. Levelling and collecting data for preparing topography map. Soil and water sampling. Ground water sampling. Measuring velocity and discharge of river.

Mode of delivery:

Face-to-face teaching, laboratory working

Learning activities and teaching methods:

Activating learning method: Lectures (15 h), group work (120 h)

Target group:

Master students in the Water and Geo Engineering and Water and Environment study options

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488115A Geomechanics

Recommended optional programme components:

-

Recommended or required reading:

Field measurements and Laboratory work instruction, lecture materials

Assessment methods and criteria:

Each exercise is evaluated graded on the scale 1-5. The final grade of the course is weighted average of following parts: participate in the lectures (5%), participate in the laboratory and field works (20% if the respective report will be presented), assignments (8%), and reports (50%), Exam (15%).

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Teacher Ali Torabi Haghighi

Working life cooperation:

No

Other information:

-

488128S: Laboratory tests in water resources engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given during the spring periods 3 and 4

Learning outcomes:

Upon completion this course, the student improves their skills of working in a team of fellow students to share expertise and execution responsibilities. The student understands the laboratory testing procedures and the associated parameters that help in estimating the water, and waste water properties. The laboratory work contains 3 main parts: fluid mechanics and open channel, water and waste water and ground water engineering.

Contents:

In the lectures: Units of measurements, error and mistake in laboratory works, how to write lab report, safety in laboratory, calibration, introduction to laboratory test in fluid mechanics and open channel hydraulics, introduction to laboratory tests in water and waste water engineering and introduction to groundwater engineering.
In laboratory: Laboratory works on Fluid mechanics and open channel hydraulics contain different method for discharge measurement, Bernoulli equation, Momentum equation, reservoir outflow, Pump and pumping, gates and wires, hydraulic jump and tracer test. Laboratory works on Ground water engineering contain hydraulic conductivity (K), specific yield (S), porosity (n) and PF curve test, Darcy low and groundwater flow, contaminant transport. Laboratory works on water and waste water engineering contain Jar test experiment, settling velocity, limestone ($CaCO_3$) filtration, aeration determination of Fe, Cl^-, Mn.

Mode of delivery:

Face-to-face teaching, laboratory working

Learning activities and teaching methods:

Activating learning method: Lectures (10 h), group work (120 h)

Target group:

Master students in the Water and Geo Engineering and Water and Environment study options

Prerequisites and co-requisites:

The required prerequisite is the completion of the following courses prior to enrolling for the course unit: 488102 Hydrological Processes, 488108S Groundwater Engineering, 488110S Water and Wastewater Treatment, 488113S Introduction to Surface Water Quality Modelling

Recommended optional programme components:

-

Recommended or required reading:

Field measurements and Laboratory work instruction, lecture materials

Assessment methods and criteria:

Each exercise is evaluated graded on the scale 1-5. The final grade of the course is weighted average of following parts participate in the lectures (5%), participate in the laboratory (20% if the respective report will be presented), assignments (10%), and reports (50%), Exam (15%).

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University Teacher Ali Torabi Haghighi

Working life cooperation:

No

Other information:

-

488121S: Fundamentals of Civil Engineering, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kauko Kujala

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course unit is held in the autumn semester, during period 1

Learning outcomes:

The student knows how to calculate stability and settlement of municipal earth structures, design the structures against frost depth and frost heave and evaluate the needs for soil improvement. The student knows risks of the excavations and slopes and can design those using mathematical theories.

Contents:

Norms and instructions, basis of geotechnical design, earth and road structures, properties of soil material and industrial by-products, slope stability, settlement calculations, soil improvement, excavations, frost depth and frost heave calculation, thaw settlement, dams and tailings, landfill bottom

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (34 h) and design and calculation exercises (10 h) also self-study (90 h)

Target group:

Master students in the Water and Geo Engineering study option of the Environmental Engineering program

Prerequisites and co-requisites:

488115A Geomechanics, 488102A, Hydrological processes, 477032A AutoCAD and Matlab in process and environmental engineering

Recommended optional programme components:

-

Recommended or required reading:

Handout and other materials delivered in lectures

Assessment methods and criteria:

Examination and homeworks

Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Kujala

Working life cooperation:

No

Other information:

-

488105A: Water Supply Networks, 5 op

Voimassaolo: 01.08.2005 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: Finnish

Leikkaavuudet:

480120A	Water Distribution and Sewerage Networks	3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course unit is given in the spring semester, in period 3

Learning outcomes:

Student knows and understands those systems what are needed for water distribution and waste water and storm water collection. Student is able to do basic dimensioning for water distribution network and sewer system of population centre.

Contents:

Water and drainage pipe design and dimensioning. Pumping and storage tanks needed in distribution of water and collection of sewage water. Control and automation of pumping stations. Observations in pipelines to prevent corrosion, effects of cold climate and harmful hydraulic impacts.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (30 h), homeworks (45 h) and a design exercise (60 h). Total 135 h.

Target group:

Students in master programs of environmental engineering

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the following course prior to enrolling for the course unit: 488010P Introduction to Environmental Engineering II, 477052A Fluid Mechanics, and 477312A Heat and Mass Transfer, or equivalent information about water management.

Recommended optional programme components:

This course is followed by 488125S Water and Wastewater Networks, Advanced Course

Recommended or required reading:

Lecture handout and other materials delivered in lectures. To the appropriate extent: RIL 237-1-2010 Vesihuolto-verkkojen suunnittelu, RIL 237-2-2010 Vesi-huoltoverkkojen suunnittelu, RIL 124-2 Vesihuolto II, Mays Water distribution systems handbook.

Assessment methods and criteria:

Examination and a design exercise.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Postdoctoral Researcher Pekka Rossi

Working life cooperation:

No

Other information:

-

488117S: Water Resources Management, 5 - 7,5 op

Voimassaolo: - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannu Marttila, Ali Torabi Haghighi

Opintokohteen kielet: English

Leikkaavuudet:

480170S Environmental Impact Assesment and Diminishing Harmful Effects in Water Resource Management 5.0 op

480212S Environmental Construction 3.5 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, during period 2

Learning outcomes:

This course introduces design concepts and principles that must be taken into account in planning of sustainable use of water resources. After the course students understand different processes, principles and mathematical methods used to manage water resources issues.

Contents:

Different water uses and interests, hydropower and dam engineering, irrigation and drainage, flood control and management, river restoration cases, sediment transport problems, peatland land use, acid sulphate soils, optimization and simulation, lake restoration, socio-ecological aspects in water resources.

Mode of delivery:

Face-to-face teaching, assignments

Learning activities and teaching methods:

Variable learning methods: Lectures and assignments

Target group:

Master students in the water engineering study options of Environmental Engineering program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes

Recommended optional programme components:

-

Recommended or required reading:

Water Resources Systems Planning and Management: An Introduction to Methods, Models and Applications. (Loucks and van Beek, 2005, ISBN 92-3-103998-9)

Assessment methods and criteria:

Variable assessment methods where each submission is graded and weighted separately: Assignment 1 (30%), Assignment 2 (20%) and Assignment 3 (50%). More detailed instructions will be given in the course. Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

D.Sc. (Tech.) Hannu Marttila

Working life cooperation:

No

Other information:

The course is arranged in alternate years (odd autumn semesters)

Water Engineering

488122S: Statistical Methods in Hydrology, 5 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Björn Klöve, Hannu Marttila

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, during period 2

Learning outcomes:

By completing the course, students will be able to understand and apply most common statistical methods used in hydrology. Students gain experience in using statistical software to solve problems for large hydrological datasets. With the software, students can present their findings with various plots which are conventional in statistical hydrology and water resources management. During the course students will be further familiarized with scientific writing and reporting.

Contents:

Course uses hydrological and meteorological data to cover topics:1) Summary statistics like mean, maximum, minimum, median, standard deviation and etc. 2) Probability distributions (normal, gamma, log-normal and generalized extreme value) visualized with histograms, box plots, and CDF’s and used in recurrence analyses. 3) Analyzing statistical significance of correlations between hydrological and meteorological variables. 4) Building and visualizing regression models and estimating the validity of the established models. 5) Trend and time series analysis using plots and statistical autoregression models.

Mode of delivery:

Face-to-face teaching, independent assignments

Learning activities and teaching methods:

In total, 135 hours of learning activities consisting of lectures (9 h), instructed computer sessions (18 h), and return assignments (108 h)

Target group:

Master students in the water engineering study options of the Environmental Engineering program

Prerequisites and co-requisites:

The prerequisite is the completion of the following courses: 488102A Hydrological Processes, and 477033A Programming in Matlab or corresponding Matlab skills

Recommended optional programme components:

-

Recommended or required reading:

Helsel, D.R., & Hirsch, R.M., 2002. Statistical Methods in Water Resources (available online). Loucks, D. P., van Beek, E., Stedinger, J.R., Dijkman J.P.M., Villars, M.T., 2005. Water Resources Systems Planning and Management (available online).

Assessment methods and criteria:

A) reports of group work on 3 return assignments (each 25% of the final grade), and B) final exam (25% of the final grade))
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Final grade of the course is average of assignments and final exam. In the numerical scale zero stands for a fail.

Person responsible:

Professor Björn Klöve

Working life cooperation:

No

Other information:

The course is arranged in alternate years (odd autumn semesters)

488124S: Advanced Course in Hydrology, 5 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Björn Klöve

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given in the autumn semester, during period 1

Learning outcomes:

In-depth knowledge on hydrology

Contents:

Hydrological processes, evapotran-spiration, climate variability and extreme events, rainfall-runoff modeling, isotope hydrology

Mode of delivery:

Face-to-face teaching and independent work with assignments

Learning activities and teaching methods:

Guided and independent process studies and modelling

Target group:

Master students in the water engineering study options of Environmental Engineering program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes, 488122S Statistical Methods in Hydrology

Recommended optional programme components:

-

Recommended or required reading:

Delivered during the course

Assessment methods and criteria:

-

Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Björn Klöve

Working life cooperation:

No

Other information:

The course is arranged in alternate years (even autumn semesters)

488113S: Basics of surface water quality modelling, 5 op

Voimassaolo: - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Anna-Kaisa Ronkanen

Opintokohteen kielet: English

Leikkaavuudet:

480210S	Environmental Impacts of Industrial Effluents	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given in the autumn semester, during period 2

Learning outcomes:

The student knows the main transport mechanisms and will be able to model water quality in lakes and streams. The students will be able to use Matlab in environmental analysis, modeling and programming.

Contents:

Introduction to modelling in water resources planning, environmental hydraulics, open channel flow, lake hydraulics, processes and water quality, dimensional analysis, hydraulic experiments, transport of conservative and reactive solutes in rivers. Modelling with ordinary differential equations, fully mixed systems, analytical and numerical methods for surface water modelling. Parameter estimation and uncertainty.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 25 h, exercises by Matlab 16 h, self-studies 94 h. Totally 135 h.

Target group:

Master students in the water engineering study options of the Environmental Engineering program

Prerequisites and co-requisites:

Basic university level knowledge of mathematics and physics is required. The required prerequisite is also the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes

Recommended optional programme components:

Matlab courses are recommended before the course unit

Recommended or required reading:

Surface Water Quality Modelling (Chapra S, 1996, ISBN 0-0701-1-364-5). Fluvial Hydraulics: Flow and Transport Processes in Channels of Simple Geometry. (Walter HG, 1998, ISBN 0-0471-97714-4). Environmental Hydraulics of Open Channel Flows (Chanson H, 2004, ISBN 0-7506-6165-8). Lecture hand-outs and other materials delivered in lectures.

Assessment methods and criteria:

Totally 4 assignments and examination must be done and are graded on the scale 1-5. The final grade of the course is average grade of them.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Anna-Kaisa Ronkanen

Working life cooperation:

No

Other information:

The course is arranged in alternate years (even autumn semesters).

488123S: River Engineering and Hydraulic Structures, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ali Torabi Haghighi

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester during period 2

Learning outcomes:

Upon completion the student should be able to applied the pervious learned courses (open channel Hydraulics, fluid mechanics and hydrology) in hydraulic structures design and river engineering, cclassify the hydraulic structures, purposes and functions of them and design hydraulic structures using river analysis software. The student knows structures for flood protection.

Contents:

Review of hydrology, open channel hydraulics and fluid mechanics, General Requirements and Design Considerations, River geomorphology and river engineering, Flood, managing and damage assessment, Erosion and sediment transport in river, River analysis system by using Hec-Ras, River stability and flood control structure Conveyance structures, Water storage structures, Protective structures, Regulating structures, Water measurement structures, Energy Dissipaters, Hec-Ras software in hydraulic structure design.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Activating learning method: Lectures (24 h), group work (35 h), independent work (30 h), self-study (40 h) and seminar (3 h)

Target group:

Master students in the water engineering study options of the Environmental Engineering program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes

Recommended optional programme components:

The course 488113S Introduction to Surface Water Quality Modelling is recommended to take before this course unit

Recommended or required reading:

Novak, P., Moffat, A. Nalluri, C. and Narayanan, R., Hydraulic Structures, 3rd ed., 2001. U.S. Bureau of Reclamation, Design of Small Dams, U.S. Government Office, 1987. U.S. Bureau of Reclamation, Design of Small canal structures, U.S. Government Office, 1974. Lecture hand-outs.

Assessment methods and criteria:

Modelling with river analysis software and technical project (40%), assignment (30%), river engineering report (30%)
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Björn Klöve and University Teacher Ali Torabi Haghighi

Working life cooperation:

No

Other information:

The course is organised every second year (on even autumn terms)

488131S: Geoenvironmental Engineering, 5 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kauko Kujala

Opintokohteen kielet: Finnish

Leikkaavuudet:

485306S	Geoenvironmental Engineering	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course unit is held in the autumn semester during period 1

Learning outcomes:

The student knows norms and instruction which are related to contaminated sites. The students can choose the suitable remediation of contaminated soil. The student can calculate contaminant transport in soils. The student can also design geotechnical structures of industrial and domestic landfills and evaluate the needs for remediation of contaminated soils. Student know how to used by-products from industry in different applications.

Contents:

Norms and instructions, there will be a project work where student will be discover a contaminated soil and a proposal remediation technique, Properties of soil material and industrial by-products, basis of geotechnical design to landfill environment, challenges of mining

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (44 h), group work (60 h) and independent work (30 h)

Target group:

Master students in the study option of Water and Geo Engineering

Prerequisites and co-requisites:

488115A Geomechanics

Recommended optional programme components:

-

Recommended or required reading:

Handout and other materials delivered in lectures

Assessment methods and criteria:

Written exam and exercises
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Anne Tuomela

Working life cooperation:

No

Other information:

-

Geo Engineering; you may also choose 488131S Geoenvironmental Engineering and 488123S River Engineering and Hydraulic Structures

488111S: Modelling in Geoenvironmental Engineering, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

485305S	Modelling in Geoenvironmental Engineering	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

The course unit is given in the spring semester, during period 4

Learning outcomes:

After the course the student can apply the numerical calculation methods in design and dimensioning of earth and geoenvironmental structures. The student can evaluate the influence of boundary conditions and material parameters in calculation results.

Contents:

Contaminant transport. Design and dimensioning of piles, tailings and dams structures. Settlement calculation due to different load types. Calculating the earth pressure of retaining walls. Freezing and thawing of earth structures.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (10 h), design and modelling assignments (58 h), self-studies (60 h)

Target group:

Master's students in the study option of Water and Geoenvironmental Engineering

Prerequisites and co-requisites:

488115A Geomechanics, 488102A, Hydrological processes, 477032A AutoCAD and Matlab in process and environmental engineering

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout and other materials delivered in lectures

Assessment methods and criteria:

Solving the given assignments and writing reports about them.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Pass/fail

Person responsible:

University teacher Anne Tuomela

Working life cooperation:

No

Other information:

-

460163S: Foundation Engineering, 5 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Liedes, Hannu Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

466104S	Foundation engineering	5.0 op

Ei opintojaksokuvauksia.

488132S: Cold Climate Engineering, 5 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Kauko Kujala
Opintokohteen kielet: English
Leikkaavuudet:

485307S	Cold Climate Engineering	5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Period 3, spring term

Learning outcomes:

By completing the course the student is able to take into account cold and arctic conditions in design, dimension and construction of civil engineering structures.

Contents:

Renewable energy principles in cold climate, arctic civil engineering and environmental protection. Thermal properties of snow, ice and soils. Coupled mass and heat transfer in soil. Frost action in soils, frost depth, frost heave and thaw consolidation. Mechanical properties of frozen soil, bearing capacity of ice. Thermal insulation of engineering structures in cold climate. Foundations in permafrost. Thawing problems of permafrost.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Face-to-face teaching 44 h including exercises

Target group:

Master students in the Water and Geo Engineering and Water and Environment study options

Prerequisites and co-requisites:

Courses (or respective knowledge): Hydrological Processes, Geomechanics, Fluid Mechanics, Heat and Mass Transfer

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes, Andersland & Andersson: Geotechnical Engineering for Cold Regions, CREEL: Snow Mechanics, CREEL report 97-3, US Army Corps of Engineers.

Assessment methods and criteria:

Exam and exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Kauko Kujala

Working life cooperation:

No

Other information:

The course will be arranged first time in year 2016

477005S: Advanced Practical Training, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Practical training

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

485002S	Advanced Practical Training	5.0 op
488002S	Advanced Practical Training	3.0 op
477002S	Advanced Practical Training	3.0 op

ECTS Credits:
5 ECTS**,** 2 months working full-time
Language of instruction:
Finnish or English
Timing:
Student usually works during the summer time
Contents:
During the practical training the student will acquaint themselves with the working environment from the point of view of his/her studies and with another possible future job, or with a different assignment already in a familiar working environment. He/she can identify the problems of the working environment and can solve them. The student can apply his/her theoretical knowledge in practical tasks. He/she identifies the tasks appropriate for the Master of Science in Technology at his/her workplace.
Mode of delivery:
Working as employee
Learning activities and teaching methods:
Students will find the training positions themselves. Suitable areas for practical training are, for example, regional environment centers, environmental engineering and consulting offices, water-works, biotechnological and food industry, chemical industry, pulp and paper industry, metallurgical and mining industry, partly electronics and automation industry, and other areas in the private and public sectors.
Target group:
Master’s students in Process and Environmental Engineering
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
-
Assessment methods and criteria:
Practical training, seminar presentation reporting their summer job. Student has to present his/her original references and submit an application form to the supervisor of the seminar. The reference must include the training period (from - to) and the duties.
Grading:
Verbal scale Passed/Failed
Person responsible:
Student councellor Saara Luhtaanmäki
Working life cooperation:
Yes
Other information:
The objective is to get a deeper and more detailed conception of the industrial area where the student will possibly work after graduation. Suitable tasks would be supervision tasks and R&D tasks.

A432253: Supplementary Module, Material Engineering, 29,5 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

465101A: Introduction to materials for mechanical engineering, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Nousiainen, Olli Pekka
Opintokohteen kielet: Finnish
Leikkaavuudet:

465061A-01 Materials Engineering I, examination 0.0 op
465061A-02 Materials Engineering I, design exercise 0.0 op
465061A-03 Materials Engineering I, laboratory exercise 1 0.0 op
465061A-04 Materials Engineering I, laboratory exercise 2 0.0 op
465061A-05 Materials engineering I, laboratory exercise 3 0.0 op
465061A Materials Engineering I 5.0 op

Ei opintojaksokuvauksia.

465102A: Materials for mechanical engineering, 5 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

465107A: Introduction to physical metallurgy, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Nousiainen, Olli Pekka
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

465115S: Processing and properties of steels, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: David Porter
Opintokohteen kielet: Finnish
Leikkaavuudet:

465089S-01 Processing and Properties of Steels, examination 0.0 op
465089S-02 Processing and Properties of Steels, laboratory exercise 0.0 op
465089S Processing and Properties of Steels 3.5 op

Ei opintojaksokuvauksia.

Choose 10 ECTS

465105A: Research techniques for materials, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Nousiainen, Olli Pekka
Opintokohteen kielet: Finnish
Leikkaavuudet:

465075A Research Techniques for Materials 3.5 op

Ei opintojaksokuvauksia.

465063S: Microstructural changes in metallic alloys, 7 op

Voimassaolo: 01.08.2013 - 31.07.2021
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: David Porter
Opintokohteen kielet: Finnish
Leikkaavuudet:

465109S Microstructural changes in metallic alloys 7.0 op
465082S-01 Physical Metallurgy II, examination 0.0 op
465082S-02 Physical Metallurgy II 0.0 op
465082S Physical Metallurgy II 7.0 op

Ei opintojaksokuvauksia.

465064S: Strength of metal alloys, 7 op

Voimassaolo: 01.08.2013 - 31.07.2021
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: David Porter
Opintokohteen kielet: Finnish
Leikkaavuudet:

465110S	Strength of metallic alloys	7.0 op
465081S	Physical Metallurgy I	7.0 op

Ei opintojaksokuvauksia.

465111S: Welding metallurgy, 8 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Leinonen, Jouko Iivari
Opintokohteen kielet: Finnish
Leikkaavuudet:

465080S-03	Welding Technology, seminar	0.0 op
465080S-01	Welding Metallurgy, examination	0.0 op
465080S-02	Welding Technology, exercise work	0.0 op
465080S	Welding Metallurgy	8.5 op

Ei opintojaksokuvauksia.

465113S: Failure mechanisms in metals, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: David Porter
Opintokohteen kielet: Finnish
Leikkaavuudet:

465079S	Failure Analysis	3.5 op

Ei opintojaksokuvauksia.

465116S: Rolling technology, 10 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jussi Paavola

Opintokohteen kielet: Finnish

Leikkaavuudet:

465090A-01 Rolling Technology, examination 0.0 op
465090A-02 Rolling Technology, exercise 0.0 op
465090A Rolling Technology 8.0 op

Ei opintojaksokuvauksia.

480429S: Maturity Test / Environmental Engineering, 0 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Tutkintorakenteisiin kuulumattomien opintokokonaisuuksien ja -jaksojen kuvaukset

488152S: Advanced Course in Traffic Engineering, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Virve Merisalo
Opintokohteen kielet: Finnish
Leikkaavuudet:

485402S Advanced Course in Traffic Engineering 5.0 op

ECTS Credits:
5 ECTS / 133 h of work
Language of instruction:
Finnish
Timing:
The course unit is given in the autumn semester, during period 2
Learning outcomes:
By completing the course the student understands the basics of transport policy and the significance of transport economics to society. The student becomes familiar with traffic safety and is able to analyse the problems of traffic safety and opportunity to improve it.
Contents:
Transport policy, transport economics, traffic safety
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 28 h, exercises 22 h, self-study 85 h
Target group:
Students in the master’s programmes of environmental engineering and mechanical engineering
Prerequisites and co-requisites:
488151A Basics of Traffic Engineering

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time
Recommended or required reading:
Materials delivered during the lectures
Assessment methods and criteria:
Examination and exercises
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
University teacher Virve Merisalo
Working life cooperation:
No
Other information:
-

488153A: Basics of Road Engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Virve Merisalo

Opintokohteen kielet: Finnish

Leikkaavuudet:

485403A	Basics of Road Engineering	5.0 op

ECTS Credits:
5 ECTS / 133 h of work
Language of instruction:
Finnish
Timing:
The course unit is held in the spring semester, during period 3
Learning outcomes:
By completing the course the student understands the basics of road design and construction, is able to calculate structure layers of road and is familiar with the maintenance of roads
Contents:
Road and street planning and design, lining, roads structure, maintenance of roads, basics of earthworks
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 28 h, exercises 22 h, self-study 85 h
Target group:
Students in master's programmes of environmental engineering and mechanical engineering
Prerequisites and co-requisites:
No
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time
Recommended or required reading:
Materials delivered during the lectures
Assessment methods and criteria:
Examination and exercises
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
University teacher Virve Merisalo
Working life cooperation:
No
Other information:
-

488151A: Basics of Traffic Engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Virve Merisalo

Opintokohteen kielet: Finnish

Leikkaavuudet:

485401A	Basics of Traffic Engineering	5.0 op

ECTS Credits:
5 ECTS / 133 h of work
Language of instruction:
Finnish
Timing:
The course unit is given in the autumn semester, during period 1
Learning outcomes:
By completing the course the student knows the basics of modes of transport, the significance of traffic and transportation to society, traffic planning and research methods, transport economics and the external effects of transport.
Contents:
Modes of transport, Need for traffic and transportation, Transport planning and research, Economical and environmental impacts of traffic, Traffic safety.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 28 h, exercises 22 h, self-study 85 h
Target group:
Students in the Master's Programmes of environmental engineering and mechanical engineering
Prerequisites and co-requisites:
No
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time
Recommended or required reading:
Materials delivered during the lectures
Assessment methods and criteria:
Examination and exercises
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
University teacher Virve Merisalo
Working life cooperation:
No
Other information:
-

477023A: Exercises of Process Engineering, 3 op

Voimassaolo: 01.01.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:
3 ECTS / 80 hours of work
Language of instruction:
English
Timing:
Periods 1-2 (available only on Autumn 2015)
Learning outcomes:
The student can describe how a heat exchanger works, and identifies some of the main mechanical unit processes (communition and flotation) and is able to explain their operation principles. The student demonstrates in the laboratory exercises that he/she can desing a process and examine reaction kinetics. The objective is that student will familiarize with occupational practice of the field and experimental research and also learn how to report results.
Contents:
The students will complete three laboratory exercises in small groups or pairs:

1. Heat exchanger, 1 ECTS cr, teacher E. Tuomaala
2. Comminution and flotation, 1 ECTS cr, teacher A. Ämmälä
3. Process design and examination of reaction kinetics, 1 ECTS cr, teacher J. Kangas

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Each sub-exercise will be done separately; and a report will be written.
Target group:
Exchange students. Please note that this course will only be available on the autumn term 2015.
Prerequisites and co-requisites:
Students taking this course must have studied the basics of process engineering (mechanical processes, heat exchange, and process design)
Recommended optional programme components:
-
Recommended or required reading:
Will be delivered separately for each sub-exercise.
Assessment methods and criteria:
Laboratory work and the report.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale 1-5 or fail
Person responsible:
University teachers (E. Tuomaala, A. Ämmälä, J. Kangas) and M. Puikkonen (Faculty Exchange Coordinator)
Working life cooperation:
No
Other information:
-

477303A: Mass Transfer, 3 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ainassaari, Kaisu Maritta, Tuomaala, Eero Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

477322A	Heat and Mass Transfer	5.0 op
470621A	Mass Transfer	3.0 op

ECTS Credits:
3 ECTS / 80 hours of work
Language of instruction:
Finnish, can be completed in English as a book examination.
Timing:

Implementation in autumn semester during 1 st period. It is recommended to complete the course at the third (Bachelor's) autumn semester. The course will be lectured last time in autumn 2015.

Learning outcomes:

After the course the student is able to explain diffusion as a phenomenon and the factors affecting it. He/she is able to model mass transfer in simple systems by using the theories of Fick and Maxwell-Stefan and to compare the models to each other. The student is capable of modeling diffusion by differential mass balances. He/she recognises the special features of mass transfer in turbulent systems and the role of different transport phenomena in mass transfer equipment. He/she has rudimentary practical skills applicable to the scale-up of the equipment used for absorption.

Contents:

Diffusion. The laws of diffusion by Fick and Maxwell-Stefan.Mass transfer in simple systems. Differential mass balances. Models of mass transfer in turbulent systems. Interphase mass transfer. Absorption.Drying of solid.

Mode of delivery:

Face-to-face teaching in Finnish. Book examination possible in English.

Learning activities and teaching methods:

Lectures 20 h, exercises 15 h, homework 10 h and self-study 35 h. For foreign students written examination based on given literature.

Target group:

Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:

Courses 477301A Momentum Transfer and 477302A Heat Transfer are recommended beforehand.

Recommended optional programme components:

This is one of the courses in which physical chemistry is used in the applications of process and environmental engineering. It is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

Bird, R,B., Stewart, W.E. & Lightfoot, E.N.: Transport Phenomena, John Wiley & Sons, 1976, 780 p.; King, C.J.: Separation Processes, McGraw-Hill, 1980, 850 p.; Wesselingh J.A. & Krishna R.: Mass Transfer, Ellis Horwood, 1990, 243 p.

Additional literature: Jokilaakso, A., Virtaustekniikan, lämmönsiirron ja aineensiirron perusteet, 496, Otakustantamo, 1987, 194 p.; Coulson, J.F. et. al.: Chemical Engineering vol.1, 4th ed., Pergamon Press, 1990. 708 p.; McCabe, W.L. et al.: Unit Operations of Chemical Engineering, 5th ed., McGraw-Hill, 1993, 1130 p.

Assessment methods and criteria:

This course utilizes continuous assessment. During the course there are 4 intermediate exams and homework. The course can also be completed by final examination. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Kaisu Ainassaari

Working life cooperation:

No

Other information:

The course will be lectured last time in autumn 2015.

477422A: Metallurgical Processes, 6 op

Voimassaolo: 01.08.2013 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Fabritius, Timo Matti Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

477414S	Process Simulation in Extractive Metallurgy	10.0 op

ECTS Credits:

6 cr / 162 hours of work

Language of instruction:

Finnish
Timing:
The course is given in the autumn semester, during periods I and II. It is recommended to complete the course at the 4th or 5th autumn semester.
Learning outcomes:
Students passing the course are familiar with the metal production processes and metallurgical unit operations used in Finland. It should also be noted that the contents of the course are under continuous development and therefore more detailed learning outcomes are given each year at the beginning of each course.
Contents:
The most important metal production processes and metallurgical unit operations used in Finland. The course is divided into various themes that are focused on: 1. Production of iron, steel and ferroalloys. 2. Production of base metals. 3. Slags. 4. Coke and other reducing agents. 5. Refractory materials. 6. Environmental load of metallurgical processes.
Mode of delivery:
Classroom education
Learning activities and teaching methods:
Group exercises and contact-education (60 hours) that supports these exercises
Target group:
Students of materials science and engineering that are interested in process metallurgy
Prerequisites and co-requisites:
Knowledge and skills corresponding with the knowledge and skills that are obtained from the Bachelor-level-studies in the programme of mechanical engineering are required as prerequisities. In order to get credits from this course, bachelor thesis must be completed.
Recommended optional programme components:
The courses of process metallurgy directed primarily to the students of materials science and engineering are 477421S and 477422A.
Recommended or required reading:
Material will be distributed during lectures and exercises. It is also available via courses www-site.
Assessment methods and criteria:
Group exercises
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Professor Timo Fabritius
Working life cooperation:
No
Other information:
It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun.

477003A: Practical Training for Exchange Students, 1 - 10 op

Opiskelumuoto: Practical Training

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
1-10 ECTS / each 3 weeks of full-time work corresponds to 1 ECTS
Language of instruction:
English
Timing:
Periods 1-2 (autumn term, September-December) or periods 3-4 (spring term, January-April), or summer (May-August)
Learning outcomes:
Variable, depending on the specific project, for example: After the practical training the student acquainted with the research working environment from the point of view of his/her studies. The student can apply his/her theoretical knowledge in practical tasks and is able to define the different stages of research work. The student is also able to classify important elements related to research, i.e. literature search, experimental work, and data processing.

The objective of the practical training is to familiarise the exchange student with scientific research especially in process and environmental engineering. The training can also give the student team working skills and increases the co-operation between the students and the research and teaching staff. The students are exposed to experiences in co-operation between other universities.

Contents:

The specific contents of the practical training period are variable, depending on the project in question

Mode of delivery:

Working as a trainee in a research group in the field of process and environmental engineering

Learning activities and teaching methods:

Variable, depending on the specific project

Target group:

Exchange students in the study programmes of process or environmental engineering

Prerequisites and co-requisites:

For bachelor level students 1-2 years, or for Master's students minimally 3 years of previous academic studies in a field suitable for the research project in question

Recommended optional programme components:

-

Recommended or required reading:

Variable, depending on the specific project

Assessment methods and criteria:

Successful completion of the reseach project

Grading:

Verbal scale Passed/Failed

Person responsible:

Supervisor(s) of the spefic project and Marita Puikkonen (Faculty Exchange Coordinator, Faculty of Technology, University of Oulu)

Working life cooperation:

Yes

Other information:

The training (internship) can only be possible if the student has been nominated to the exchange by his/her home university, and if he/she has submitted an application for the exchange internship through the online system SoleMOVE in time in respect to the deadlines. Further, a placement agreement must have been signed between the site of the training (the supervisors), the faculty exchange coordinator, the home university and the student. The agreement must be enclosed to the SoleMOVE application.

477321S: Research Ethics, 3 op

Voimassaolo: - 31.07.2019

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

Leikkaavuudet:

477312S	Science and Professional Ethics	5.0 op

ECTS Credits:

3 ECTS / 80 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during 3 rd period

Learning outcomes:

After the course the student is capable of explaining the meaning of research integrity and good scientific practice including honesty, conscientiousness and precision in research work. The student is able to plan, carry out and report his/her research work, and is aware of the rights and responsibilities of a researcher and his/her actions and respect towards other researchers. The student is able to recognise misconduct and fraud in scientific practices and has an awareness of how to handle misconduct.

Contents:

Ethically sound research, Scientific community and ethical problems in research work. Professional ethics of a researcher and an engineer. Research intergrity, good scientific practices and handling of misconduct and fraud in science. Regulations and rules. Definitions, Characteristic features of science, Research results and responsible persons in scientific work, Ethics and research ethics, Professional ethics of a researcher, Research integrity in Finland and globally, Instructions for preventing, handling and examining misconduct and fraud in scientific research, Good scientific practices and responsibility in performing research, Good practices in selecting the research problem, collecting the material, planning and performing the research, publishing, using and applying the results, Protection of a researcher under the law, Examples and statistics.

Mode of delivery:

Lectures and team work, face-to-face teaching

Learning activities and teaching methods:

Lectures 25 h, practical work 15 h, self-study 40 h

Target group:

Master's degree students of the Process and Environmental Engineering study programmes.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Clarkeburn, H. & Mustajoki, A. Tutkijan arkipäivän etiikkaa. Tampere 2007, Vastapaino.319 p., Responsible Conduct of Research and Procedures for Handling Allegations of Misconduct in Finland. Helsinki 2012, TENK, Finnish Advisory Board on Research Integrity, Martin, M.W. &Schinzinger, R. Ethics in Engineering, 4th Edition. New York, 2005, McGraw Hill Co. 339 p, Heikkerö, T. Tekniikka ja etiikka, Johdatus teoriaan ja käytäntöön, Espoo 2009, Tekniikan Aktateemisten Liitto, TEK, 160 s.

Additional literature: Hallamaa, J., Launis, V., Lötjönen, S. & Sorvali, I. Etiikkaa ihmistieteille. Tietolipas 211, Suomen Kirjallisuuden Seura, Helsinki 2006. 428 p., Pietilä, A.-M. & Länsimies-Antikainen, H. (Toim.) Etiikkaa monitieteisesti, Pohdintaa ja kysymyksiä. Kuopio 2008, Kuopio University Publications F. University Affairs 45.224 p.

Assessment methods and criteria:

Practical work assignments affect the course grade. Examination and a learning diary. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Riitta Keiski

Working life cooperation:

No

Other information:

-

488154S: Road Design and Construction, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Virve Merisalo

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

Finnish

Timing:

The course unit is held in the spring semester, during period 4

Learning outcomes:

By completing the course the student is familiar with road structure and function, structural modernisation, pavements and the basics of earthworks. He/she is also able to design road computer aided.

Contents:

Function of road structure, road damaging, structural modernisation, pavements, Road design and construction

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 28 h, exercises 32 h, self-study 75 h
Target group:
Students in the master's programmes of environmental engineering and mechanical engineering
Prerequisites and co-requisites:
488153A Road Design and Construction, and 488051A AutoCAD and Matlab in process and environmental engineering
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time
Recommended or required reading:
Materials delivered during the lectures
Assessment methods and criteria:
Examination and exercises
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Yliopisto-opettaja Virve Merisalo
Working life cooperation:
No
Other information:
-

477010A: Special Exercise of Process Engineering, 3 - 10 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
1-10 ECTS / 27-270 hours of work
Language of instruction:
English
Timing:
Periods 1-2 (autumn term, September-December) or periods 3-4 (spring term, January-April), or summer (May-August)
Learning outcomes:
Variable, depending on the specific literature project, but he objective is to familiarise the exchange student with scientific reporting / writing research papers scholarly, especially about process and environmental engineering related topics
Contents:
Variable, but can include for example literature searches through various information sources, writing a scientific texts, referring, etc.
Mode of delivery:
Working as a trainee in a research group in the field of process and environmental engineering with a task to write a reseach paper
Learning activities and teaching methods:
Variable, depending on the specific literature project
Target group:
Exchange students in the study programmes of process or environmental engineering
Prerequisites and co-requisites:
For bachelor level students 1-2 years, or for Master’s students minimally 3 years of previous academic studies in a field suitable for the research topic in question.
Recommended optional programme components:
-
Recommended or required reading:
Variable, depending on the specific topic
Assessment methods and criteria:

Successful completion of the literatuer project tasks
Grading:
Verbal scale Passed/Failed
Person responsible:
Supervisor(s) of the spefic project and Marita Puikkonen (Faculty Exchange Coordinator, Faculty of Technology, University of Oulu)
Working life cooperation:
Yes
Other information:
The training (internship) can only be possible if the student has been nominated to the exchange by his/her home university, and if he/she has submitted an application for the exchange internship through the online system SoleMOVE in time in respect to the deadlines. Further, a placement agreement must have been signed between the site of the training (the supervisors), the faculty exchange coordinator, the home university and the student. The agreement must be enclosed to the SoleMOVE application.

477006S: Supplementary Practical Training, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Practical training

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS**,** 2 months working full-time
Language of instruction:
Finnish or English
Timing:
Student usually works during the summer time within his/her Master's studies
Learning outcomes:
During the practical training the student will acquaint themselves with the working environment from the point of view of his/her Master's studies and with yet another possible future job. He/she can identify the problems of the working environment and solve them. The student can apply his/her theoretical knowledge in practical tasks. He /she identifies the tasks appropriate for the Master of Science in Technology at his/her workplace.
Contents:
Students will find the training positions themselves. Suitable areas for practical training are, for example, regional environment centers, environmental engineering and consulting offices, water-works, biotechnological and food industry, chemical industry, pulp and paper industry, metallurgical and mining industry, partly electronics and automation industry, and other areas in the private and public sectors.
Mode of delivery:
Working as an employee
Learning activities and teaching methods:
-
Target group:
Master's students in Process and Environmental Engineering
Prerequisites and co-requisites:
The student must have completed course 477005S Advanced Practical Training before he/she can get the credits from this course.
Recommended optional programme components:
-
Recommended or required reading:
-
Assessment methods and criteria:
The student has to present their original references and submit an application form and a training report to the Study councellor for the assessment. The reference must include the training period (from - to) and the duties. The acceptance of the Supplementary can be done during any phase of the Master's studies. No work experience aquired before the studies can be credited as the supplementary practical training but the trainging can only be accepted when it has been done during the studies.
Grading:
Verbal scale Passed/Failed

Person responsible:
Study councellor Saara Luhtaanmäki
Working life cooperation:
Yes
Other information:
The objective is to give a deeper and more detailed conception of the industrial area where the student will possibly work after graduation. Suitable tasks would be supervision tasks and R&D tasks.

488402S: Sustainable Development, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488402A	Sustainable Development	3.0 op

ECTS Credits:
3 ECTS / 80 hours of work
Language of instruction:
English
Timing:
Autumn period 2
Learning outcomes:
The student is able to explain the principles of sustainable development and its environmental, economic and social dimensions; knows the goals and indicators of sustainability; and is able outline the future perspectives on the prosperity of human, economic and technological systems.
Contents:
Multidisciplinary, intensive and interactive course. After an introductory presentation on the fundamentals of sustainable development; students will select a subject of their interest and prepare their own presentation on it with the help of expert mentors. The key issues to discuss include core concepts and tools such as SD goals and indicators, environmental justice, cultural diversity, international cooperation and action toward sustainable development and some additional subjects that can vary depending on recent advances or emerging trends each year, such as resource scarcity and conflicts, resilience of human and environmental systems; governance; business and globalization; and issues relating to technological change. As an exercise, a court case simulation is organized, in which every year a subject of current interest is "on trial".
Mode of delivery:
Implemented as face-to-face teaching and student seminar. The course largely relies on participatory learning, therefore, there are compulsory participation requirements.
Learning activities and teaching methods:
Lectures, discussions, student presentations, opponency, group work, court case simulation
Target group:
Master's students of environmental engineering, especially of international master's programmes such as the Master's Degree Programme (BCBU) in Environmental Engineering (BEE)
Prerequisites and co-requisites:
For BEE students, admission to the Master's programme, for which minimally a former bachelor's degree is required. For other students the Bachelor level studies in process or environmental engineering or respective knowledge
Recommended optional programme components:
Communicates with the course of Industrial Ecology, but both courses can be taken independently
Recommended or required reading:
Lecture materials are recommended during the course by course lecturers and mentors. All materials are available through Optima.
Assessment methods and criteria:
Quality of student presentations, activity in discussions, performance as an opponent and in the court case simulation. Read more about assessment criteria at the University of Oulu webpage.
Grading:

The course evaluation will be based on participation and activity during the course. The course unit utilizes a numerical grading scale 1-5 (accepted grades) and zero stands for a fail.

Person responsible:

University teacher Virpi Väisänen

Working life cooperation:

No

Other information:

The course description here is also valid for the code 488402A

477421S: Thermodynamics in Metallurgy, 6 op

Voimassaolo: 01.08.2013 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

Leikkaavuudet:

477412S	Phenomena-based modelling in extractive metallurgy	10.0 op

ECTS Credits:

6 cr / 162 hours of work

Language of instruction:

Finnish

Timing:

The course is given in the autumn semester, during periods I and II. It is recommended to complete the course at the 4th or 5th autumn semester.

Learning outcomes:

Students passing the course are familiar with the most important computational methods used to investigate the most essential chemical phenomena in the research and development of metallurgical processes. Students can e. g. calculate thermodynamic equilibria, read and construct phase stability diagrams as well as other diagrams used in the investigation of pyrometallurgical and electrochemical reactions, etc. It should however be noted that these are only examples since the contents of the course are under continuous development and therefore more detailed learning outcomes are given each year at the beginning of each course.

Contents:

Models and methods that are used to investigate the most essential chemical phenomena in the research and development of metallurgical processes. The course is divided into various themes that are focused on: 1.Phase stability diagrams. 2. Computational thermodynamics. 3. Thermodynamic modelling of metallurgical solutions. 4. Thermodynamics and kinetics of electrochemical reactions. 5. Corrosion.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Individual and group exercises as well as contact-education (60 hours) that supports these exercises.

Target group:

Students of materials science and engineering that are interested in process metallurgy

Prerequisites and co-requisites:

Knowledge and skills corresponding with the knowledge and skills that are obtained from the Bachelor-level-studies in the programme of mechanical engineering are required as prerequisities. In order to get credits from this course, bachelor thesis must be completed.

Recommended optional programme components:

The courses of process metallurgy directed primarily to the students of materials science and engineering are 477421S and 477422A

Recommended or required reading:

Material will be distributed during lectures and exercises. It is also available via courses www-site.

Assessment methods and criteria:

Individual and group exercises

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University lecturer Eetu-Pekka Heikkinen
Working life cooperation:
No
Other information:
It is highly recommended that the students are present already in the first lecture, since it is not possible to come along after the course has already begun.

488125S: Water and Waste Water Networks, Advanced Course, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS /133 hours of work
Language of instruction:
Finnish
Timing:
No set schedule. The course can be taken during all periods 1-4. Discuss with person responsible (see below) to agree about the schedule.
Learning outcomes:
After the course, the student understands the effect of water and wastewater supply networks on water quality of drinking water and on properties of wastewater. The student is familiar with risk of the networks and knows how to manage damages in networks. The student can also take consider extreme situations in planning and designing water supply networks.
Contents:
Extreme situations and management in water supply networks, physical and chemical processes in networks and impact of the processes on water quality and on damage of networks.
Mode of delivery:
Self-study package
Learning activities and teaching methods:
Self-studies (135 h), book examamination
Target group:
Students in Master programs of environmental engineering
Prerequisites and co-requisites:
To be able to register for the book exam, the student must have previously completed the course 488105A Water Supply Networks
Recommended optional programme components:
This advanded course follows a previous course 488105A Water Supply Networks
Recommended or required reading:
Virtaustekniikka, Pulli M, 2009. 248 s. Sewer processes, Hvitved-Jacobsen, 2002. 237 s. Puhdistuksen tarve ja merkitys vesijohtoverkostossa, Vesi- ja viemärilaitosyhdistys, 1999. 29 s. Vesijohtoverkostojen putkirikkotilanteet ja niiden hallittu korjaaminen, Vesi- ja viemärilaitosyhdistys, 2011. 61 s.
Assessment methods and criteria:
Examination
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Postdoctoral Researcher Pekka Rossi
Working life cooperation:
No
Other information:
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477008A: Working Life Skills, 1 - 10 op

Voimassaolo: 01.07.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Saara Luhtaanmäki

Opintokohteen kielet: Finnish

ECTS Credits:
1-10 ECTS / The amount of working hours depends on which sub parts and how much the student will do
Language of instruction:
Finnish/ English, language of instruction depends on what student will do and where
Timing:
The parts of the course can be taken during the whole calendar year, depending on the specific sub parts
Learning outcomes:
After the course, the student will have aquired a variety of working life skills, such as experience of team management, giving presentations, organization of events, etc. In addition, the student has seen a variety of jobs, met some possible employers, and created his/herown contact network
Contents:
The course consist of one or more of the next parts: The Military Leader Education (1 ECTS), Tutoring a New Students Group (1 ECTS), Visits/Excursions (1 ECTS), Participation to Student Recruiting Fairs / Organizing an Exhibition (1-2 ECTS), Recruiting in High Schools (1 ECTS), Participation to Student Organizational Activities (1-2 ECTS), and/or Special Project (1-2 ECTS)
Mode of delivery:
There are no organized lectures
Learning activities and teaching methods:
Students collect course parts from activities within their student community and to support their professional growth
Target group:
All major students of process and environmental engineering
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
-
Assessment methods and criteria:
The student has to keep a learning diary (a report) for each of the chosen parts. The diary should be submitted to the student counsellor:
The Military Leader Education (1 ECTS): You need to submit an attested certificate ”Johtajan palvelutodistus ja henkilöarviointi” to the student counsellor.
Tutoring a New Students Group (1 ECTS): Participate to the New Students Tutor's trainings, meetings and plan, organize and implement your tutoring. Write notes on all meetings and tutor courses to a learning diary, include there also your tutoring plan and a feedback on the course.
Visits/Excursions (1 ECTS): You have to report the target and time of the visit/excursion, what you learned there and how it impacted to your studies and career. You need 7 visits for 1 ECTS.
Participation to Student Recruiting Fairs/Organizing an Exhibition (1-2 ECTS): Report in the diary what, when and how long you worked for the student recruiting fair or exhibition. How your work there affect the recruiting process?
Recruiting in High Schools (1 ECTS): You have to give 10 presentations in high schools for 1 ECTS. Report where and when you have been and how many students listened to you.
Participation to Student Organizational Activities (1-2 ECTS): Report what you have done, how long and what did you learn? You need full one term's activities for 1 ECTS.
Special Project (1 -2 ECTS): You can report other projects which support your studies but do not officially accumulate to your study credits. This can be for example a Demola project. In the report (the learning diary) you have to reflect what you learned, how long it took, who were your coworkers. Add a project plan and abstract from the project’s closing report to your diary.
Grading:
The course utilizes verbal grading scale “pass/ fail”.
Person responsible:
Student counsellor Saara Luhtaanmäki
Working life cooperation:
Yes
Other information:

This course is part of the Supplementary Module in the Master’s Degree programme curriculum. The final amount of credits attained for this course will be compiled at end of studies.