Opasraportti

FTech - Field of Process and Environmental Engineering (2018 - 2019)

Tutkintorakenteet

Master of Science (Tech), Process Engineering

Tutkintorakenteen tila: published

Lukuvuosi: 2018-19

Lukuvuoden alkamispäivämäärä: 01.08.2018

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
- *Bridge Studies*
  - 031075P: Calculus II, 5 op
  - 031076P: Differential Equations, 5 op
  - 031078P: Matrix Algebra, 5 op
  - 477203A: Process Design, 5 op
  - 477304A: Separation Processes, 5 op
  - 477401A: Thermodynamic Equilibria, 5 op
  - 477121A: Particle Technology, 5 op
  - 477122A: Bulk Solids Handling, 5 op
  - 477222A: Reactor Analysis, 5 op
  - 477052A: Fluid Mechanics, 5 op
  - 477621A: Control System Analysis, 5 op
  - 477622A: Control System Design, 5 op
  - 477201A: Material and Energy Balances, 5 op
  - 477322A: Heat and Mass Transfer, 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

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 25 ECTS
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
477626S: Building Automation Project, 5 - 10 op

Module of the Option, Bioproducts and Bioprocess Engineering

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

A431238: Module of the Option/Chemical Engineering, 60 op
Compolsory
477306S: Non-ideal Reactors, 5 op
477309S: Process and Environmental Catalysis, 5 op
477311S: Advanced Separation Processes, 5 op
477310S: Advanced Catalytic 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

A431233: Module of the Option/Extractive Metallurgy, 30 op
Choose 30 or 60 ECTS
477415S: Thermodynamic and process modelling in metallurgy, 5 op
477416S: High temperature processes, 5 op

477417S: High temperature chemistry, 5 op
477418S: Experimental methods of high temperature research, 10 op
477419S: Seminar in metallurgy, 5 op
781649S: Sampling and Sample Pretreatment, 5 op
781657S: Experimental Design, 5 op
782640S: Chemistry of Hydrometallurgical Processes, 5 op
782638S: Chemistry in Industrial Applications, 5 op
782637S: Surface Chemistry, 5 op
782639S: Electrochemistry, 5 op
780670S: Special Lecture, 0 op

Module of the Option, Energy Systems and Cleaner Production

A431239: Module of the Option/ Energy Systems and Cleaner Production, 60 op
Compolsory
477224S: Biorefineries, 5 op
477309S: Process and Environmental Catalysis, 5 op
488402S: Sustainable Development, 5 op
488203S: Industrial Ecology, 5 op
488202S: Production and Use of Energy, 5 op
Choose the other
477307S: Research Methodology, 5 op
488143S: Environmental Impact Assessment, 5 op
Choose Energy Systems or Cleaner Production
H432232: Module of the Option/Energy Systems, 30 op
Compolsory
488501S: Smart Grid I: Integrating renewable energy sources, 5 op
488502S: Smart Grid II: Smart buildings/smart customers in the smart grid, 5 op
488503S: Smart Grid III: Smart energy networks, 5 op
488504S: Fundamentals of nuclear energy, 5 op
488206S: Sustainable Energy Project, 5 op
477625S: Power Plant Automation, 5 op
H432233: Module of the Option/Cleaner Production, 30 op
Compolsory
488204S: Air Pollution Control Engineering, 5 op
488221S: Environmental Load of Industry, 5 op
477223S: Advanced Process Design, 5 op
477207S: Industrial Water and Wastewater Technologies, 5 op
477306S: Non-ideal Reactors, 5 op
Choose the other, Courses only every second year
477310S: Advanced Catalytic Processes, 5 op
477311S: Advanced Separation Processes, 5 op

Module of the Option, Water and Geo Engineering

A431237: Module of the Option/Water and Geo Engineering, 60 op
Compolsory
488110S: Water and Wastewater Treatment, 5 op
488134S: Hydrogeology and groundwater engineering, 5 op
488127S: Field measurements, site investigations and geotechnical tests, 5 op
488128S: Laboratory tests in water resources engineering, 5 op
488135S: Water distribution and sewage networks, 5 op
488131S: Geoenvironmental Engineering, 5 op
488136S: Integrated water resources management, 5 op
Choose Water or Geo Engineering
H432234: Module of the Option/Water Engineering, 25 op
Choose 25 ECTS
488137S: Statistical hydrology, 5 op
488138S: Cold climate hydrology, 5 op
488139S: Surface water quality modelling, 5 op
488123S: River Engineering and Hydraulic Structures, 5 op
488140S: Groundwater modelling and management, 5 op
488143S: Environmental Impact Assessment, 5 op

488141S: Urban hydrology, 5 op
H432235: Module of the Option/Geo Engineering, 25 op
Choose 25 ECTS
488111S: Modelling in Geoenvironmental Engineering, 5 op
488129S: Foundation Engineering, 5 op
488121S: Fundamentals of Civil Engineering, 5 op
488140S: Groundwater modelling and management, 5 op
488141S: Urban hydrology, 5 op

Supplementary Module (30 op)

Course 477005S Practical Training, 5 ECTS is compulsory. All other courses student can choose free.

477005S: Advanced Practical Training, 5 op

Free choice courses

Supplementary Module, Material Engineering

A431252: Supplementary Module, Material Engineering, 29,5 op
Compulsory; this module is suitable for the students of Processmetallurgy either advanced or supplementary module
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

Traffic Engineering

A432257: Supplementary Module, Traffic Engineering, 5 - 60 op
Electives
488151A: Basics of Traffic Engineering, 5 op
488152S: Advanced Course in Traffic Engineering, 5 op
488153A: Basics of Road Engineering, 5 op
488154S: Road Design and Construction, 5 op

Structural Engineering

A432258: Supplementary Module, Structural Engineering, 5 - 60 op
Electives
461102A: Statics, 5 op
461103A: Strength of materials I, 5 op
466101A: Introduction to building construction, 5 op
466107S: Design of concrete structures, 6 op
466109S: Concrete technology, 5 op
461107A: Finite Element Methods I, 5 op
461106A: Dynamics, 5 op
466102A: Introduction to structural design, 3 - 5 op
485021A: Construction Contracting, 5 op

Master's Thesis (30 op)

Choose Master's Thesis 30 ECTS.

477980S: Master's Thesis in Process Engineering, 30 op
470313S: Maturity Test / Process Engineering, 0 op

Master of Science (Tech), Environmental Engineering

Tutkintorakenteen tila: published

Lukuvuosi: 2018-19

Lukuvuoden alkamispäivämäärä: 01.08.2018

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 on 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
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
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
477013P: Introduction to Process and Environmental Engineering, 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
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
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

A431238: Module of the Option/Chemical Engineering, 60 op
Compolsory
477306S: Non-ideal Reactors, 5 op
477309S: Process and Environmental Catalysis, 5 op
477311S: Advanced Separation Processes, 5 op
477310S: Advanced Catalytic 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

A432231: Module of the Option/Extractive Metallurgy, 30 op
Choose 30 or 60 ECTS
477415S: Thermodynamic and process modelling in metallurgy, 5 op
477416S: High temperature processes, 5 op
477417S: High temperature chemistry, 5 op
477418S: Experimental methods of high temperature research, 10 op
477419S: Seminar in metallurgy, 5 op
781649S: Sampling and Sample Pretreatment, 5 op
781657S: Experimental Design, 5 op
782640S: Chemistry of Hydrometallurgical Processes, 5 op
782638S: Chemistry in Industrial Applications, 5 op
782637S: Surface Chemistry, 5 op
782639S: Electrochemistry, 5 op

780670S: Special Lecture, 0 op

Module of the Option, Energy Systems and Cleaner Production

A431239: Module of the Option/ Energy Systems and Cleaner Production, 60 op
Compolsory
477224S: Biorefineries, 5 op
477309S: Process and Environmental Catalysis, 5 op
488402S: Sustainable Development, 5 op
488203S: Industrial Ecology, 5 op
488202S: Production and Use of Energy, 5 op
Choose the other
477307S: Research Methodology, 5 op
488143S: Environmental Impact Assessment, 5 op
Choose Energy Systems or Cleaner Production
H432232: Module of the Option/Energy Systems, 30 op
Compolsory
488501S: Smart Grid I: Integrating renewable energy sources, 5 op
488502S: Smart Grid II: Smart buildings/smart customers in the smart grid, 5 op
488503S: Smart Grid III: Smart energy networks, 5 op
488504S: Fundamentals of nuclear energy, 5 op
488206S: Sustainable Energy Project, 5 op
477625S: Power Plant Automation, 5 op
H432233: Module of the Option/Cleaner Production, 30 op
Compolsory
488204S: Air Pollution Control Engineering, 5 op
488221S: Environmental Load of Industry, 5 op
477223S: Advanced Process Design, 5 op
477207S: Industrial Water and Wastewater Technologies, 5 op
477306S: Non-ideal Reactors, 5 op
Choose the other, Courses only every second year
477310S: Advanced Catalytic Processes, 5 op
477311S: Advanced Separation Processes, 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
488110S: Water and Wastewater Treatment, 5 op
488134S: Hydrogeology and groundwater engineering, 5 op
488127S: Field measurements, site investigations and geotechnical tests, 5 op
488128S: Laboratory tests in water resources engineering, 5 op
488135S: Water distribution and sewage networks, 5 op
488136S: Integrated water resources management, 5 op
488131S: Geoenvironmental Engineering, 5 op
Choose water or geo engineering (Geo Engineering is in Finnish)
H432234: Module of the Option/Water Engineering, 25 op
Choose 25 ECTS
488137S: Statistical hydrology, 5 op
488138S: Cold climate hydrology, 5 op
488139S: Surface water quality modelling, 5 op
488123S: River Engineering and Hydraulic Structures, 5 op
488140S: Groundwater modelling and management, 5 op
488143S: Environmental Impact Assessment, 5 op
488141S: Urban hydrology, 5 op
H432235: Module of the Option/Geo Engineering, 25 op
Choose 25 ECTS
488111S: Modelling in Geoenvironmental Engineering, 5 op
488129S: Foundation Engineering, 5 op
488121S: Fundamentals of Civil Engineering, 5 op
488140S: Groundwater modelling and management, 5 op
488141S: Urban hydrology, 5 op

Supplementary Module (30 op)

Course 477005S Practical Training, 5 ECTS is compulsory. All other courses student can choose free.

477005S: Advanced Practical Training, 5 op

Free choice courses

Supplementary Module, Material Engineering

A431252: Supplementary Module, Material Engineering, 29,5 op
Compulsory; this module is suitable for the students of Processmetallurgy either advanced or supplementary module
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

Traffic Engineering

A432257: Supplementary Module, Traffic Engineering, 5 - 60 op
Electives
488151A: Basics of Traffic Engineering, 5 op
488152S: Advanced Course in Traffic Engineering, 5 op
488153A: Basics of Road Engineering, 5 op
488154S: Road Design and Construction, 5 op

Structural Engineering

A432258: Supplementary Module, Structural Engineering, 5 - 60 op
Electives
461102A: Statics, 5 op
461103A: Strength of materials I, 5 op
466101A: Introduction to building construction, 5 op
466107S: Design of concrete structures, 6 op
466109S: Concrete technology, 5 op
461107A: Finite Element Methods I, 5 op
461106A: Dynamics, 5 op
466102A: Introduction to structural design, 3 - 5 op
485021A: Construction Contracting, 5 op

Master's Thesis (30 op)

Choose Master's Thesis 30 ECTS.

488980S: Master's Thesis in Environmental Engineering, 30 op
480429S: Maturity Test / Environmental Engineering, 0 op

Bachelor of Science (Tech), Process and Environmental Engineering

Tutkintorakenteen tila: published

Lukuvuosi: 2018-19

Lukuvuoden alkamispäivämäärä: 01.08.2018

Basic Studies (70 op)

A433123: Basic Studies, Process and Environmental Engineering, 70 op
- *Compolsory*
  - 477013P: Introduction to Process and Environmental Engineering, 5 op
  - 477000P: Planning of Studies and Career, 1 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
  - 761118P: Mechanics 1, 5 op
    - *Compulsory*
      - 761118P-01: Mechanics 1, lectures and exam, 0 op
      - 761118P-02: Mechanics 1, lab. exercises, 0 op
  - 761119P: Electromagnetism 1, 5 op
  - 780116P: Introduction to Organic Chemistry, 5 op
  - 780120P: Basic Principles in Chemistry, 5 op
  - 030005P: Information Skills, 1 op
  - 488051A: AutoCAD and Matlab in Process and Environmental Engineering, 5 op
  - 780123P: Introductory Laboratory Works in Chemistry, 5 op
- *Choose Languages, 6 ECTS English or German*
  - 902150Y: Professional English for Technology, 2 op
  - 902142Y: Business Correspondence, 2 op
  - 902145Y: Working Life Skills, 2 op
  - 902146Y: Presentation Skills, 2 op
  - 902147Y: Academic Vocabulary for Science and Technology, 2 op
  - 902149Y: Mechanics of Writing, 2 op
  - 903030Y: Intermediate Course in German 2, 3 - 4 op
  - 903042Y: Intermediate Course in German 3, 2 - 4 op
  - 903048Y: Intermediate Course in German IV, 2 - 4 op
- *Choose the Second Language*
  - 901044Y: Second Official Language (Swedish), Written Skills, 1 op
  - 901045Y: Second Official Language (Swedish), Oral Skills, 1 op
  - 900081Y: Second Official Language (Finnish), Written Skills, 1 - 2 op
  - 900082Y: Second Official Language (Finnish), Oral Skills, 1 - 3 op

Intermediate Studies (60 op)

A433125: Intermediate Studies, Process and Environmental Engineering, 60 op
- *Compolsory*
  - 477051A: Automation Engineering, 5 op
  - 477052A: Fluid Mechanics, 5 op
  - 477121A: Particle Technology, 5 op
  - 477122A: Bulk Solids Handling, 5 op
  - 477201A: Material and Energy Balances, 5 op
  - 477401A: Thermodynamic Equilibria, 5 op
  - 477222A: Reactor Analysis, 5 op
  - 477322A: Heat and Mass Transfer, 5 op
  - 477304A: Separation Processes, 5 op
  - 477502A: Experiment design and analysis, 5 op
  - 555225P: Basics of industrial engineering and management, 5 op
  - 555265P: Occupational Safety and Health Management, 5 op

Module preparing for the Option (40 op)

Choose one of following modules. If you are student of Process Engineering, you have on choice. If you are student of Environmental Engineering, you have two different kind of modules. Those modules starts you master's studies option.

Process Engineering

A431127: Module Preparing for the Option: Process Engineering, 40 op
Compolsory
477004A: Practical Training, 5 op
477402A: Solid Inorganic Materials, 5 op
488052A: Introduction to Bioproduct and Bioprocess engineering, 5 op
488309A: Biocatalysis, 5 op
477203A: Process Design, 5 op
477621A: Control System Analysis, 5 op
477622A: Control System Design, 5 op
477501A: Process dynamics, 5 op

Environmental Engineering

A432129: Module Preparing for the Option: Environmental Engineering/Energy and Environmental Engineering, 40 op
Choose the Other
477004A: Practical Training, 5 op
488201A: Environmental Ecology, 5 op
488142A: Environmental legislation and EIA, 5 op
477402A: Solid Inorganic Materials, 5 op
488130A: Waste management and resources recovery, 5 op
488052A: Introduction to Bioproduct and Bioprocess engineering, 5 op
488309A: Biocatalysis, 5 op
477203A: Process Design, 5 op
A432128: Module Preparing for the Option: Environmental Engineering/Water and Geo Engineering, 40 op
Choose the other
477004A: Practical Training, 5 op
488201A: Environmental Ecology, 5 op
488142A: Environmental legislation and EIA, 5 op
488130A: Waste management and resources recovery, 5 op
477621A: Control System Analysis, 5 op
488102A: Hydrological Processes, 5 op
488115A: Geomechanics, 5 op
485021A: Construction Contracting, 5 op

Bachelor's Thesis (10 op)

Choose right Bachelor's Thesis.

H432236: Bachelor’s Thesis, Process and Environmental Engineering, 8 op
Choose the Other
477990A: Bachelor's Thesis / Process Engineering, 8 op
488990A: Bachelor's Thesis / Enviromental Engineering, 8 op
900060A: Technical Communication, 2 op

Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

466113S: Construction economics, 5 op

Opintojaksojen kuvaukset

Tutkintorakenteisiin kuuluvien opintokohteiden kuvaukset

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.

Bridge Studies

031075P: Calculus II, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Applied Mathematics and Computational Mathematics
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 ECTS credits / 135 hours of work

Language of instruction:

Finnish. The course can be completed in English by intermediate exams or by a final exam.

Timing:

Spring semester, period 3

Learning outcomes:

Upon completion of the course, the student is able to examine the convergence of series and power series of real terms, can explain the use of power series e.g. in calculating limits, 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 22 h / Self-study 85 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the course 031010P Calculus I.

Recommended optional programme components:

-

Recommended or required reading:

Kreyszig, E: Advanced Engineering Mathematics; Grossman S.I.: Multivariable Calculus, Linear Algebra, and Differential Equations; Adams, R.A.: A Complete Course Calculus.

Assessment methods and criteria:

Intermediate exams or a final exam.
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:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

031076P: Differential Equations, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Ruotsalainen Keijo

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

Finnish

Timing:

The course is held in the spring, during period 4. It is recommended to complete the course at the 1th spring semester.

Learning outcomes:

The students can apply differential equations as a mathematical model. They can identify and solve various differential equations and they have knowledge on basic solvability of differential equations. The student can use the Laplace transform as a solution method.

Contents:

Ordinary differential equations of first and higher order.
Laplace transform with applications to differential equations.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h / Group work 22 h / Self-study 85 h.

Target group:

1. year students of technical sciences, mathematics and physics.

Prerequisites and co-requisites:

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

Recommended optional programme components:

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Recommended or required reading:

Recommented literature: Kreyszig, E: Advanced Engineering Mathematics;

Assessment methods and criteria:

The course can be completed by intermediate exams (2 exams) or by a final exam.
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:

Keijo Ruotsalainen

Working life cooperation:

-

Other information:

-

031078P: Matrix Algebra, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

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

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

Finnish

Timing:

The course is held in the autumn, during period 2. It is recommended to complete the course at the 1th autumn semester.

Learning outcomes:

The student is able to apply arithmetic operations of matrices and can solve system of linear equations by matrix methods and can apply matrix factorizations to find the solution of the system of linear equations. The student is able to recognize the vector space and understands the concepts of basis and dimension of a vector space and can analyse matrices by the parameters, vectors and vector spaces of matrices. He /She knows how to calculate determinant, eigenvalues and eigenvectors of a square matrix, and is able to diagonalize matrices and apply diagonalization to the simple problems.

Contents:

1. Vectors and matrices 2. Systems of linear equations. 3. Matrix factorizations. 4. Vector spaces. 5. The rank, nullity, row space and the column space of a matrix. 6. The determinant of a matrix. 7. Eigenvalues and eigenvectors of a matrix. 8. The diagonalization with applications.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h / Group work 22 h / Self-study 85 h.

Target group:

1. year students of technical sciences, mathematics and physics.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Recommented literature: Grossman, S.I: Elementary Linear Algebra; David C. Lay: Linear Algebra and Its Applications.

Assessment methods and criteria:

The course can be completed by intermediate exams (2 exams) or by a final exam.
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:

Matti Peltola

Working life cooperation:

-

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:

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-economic performance of the process based on holistic criteria.

Contents:

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

Dr Jani Kangas

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

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 the 2nd period. 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:

-

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:

Finnish

Timing:

The course is held in the autumn semester, during period I. It is recommended to complete the course at the 2nd autumn semester.

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 (26 hours), software exercises (4 hours) as well as other exercises. Only in Finnish.

Target group:

Students of process and environmental engineering

Prerequisites and co-requisites:

'Basic Principles in Chemistry' or corresponding knowledge is recommended as prerequisite.

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. It is also available via courses www-site.

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.

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:

There is no direct working life cooperation in this course.

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.

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

Opettajat: Elisa Koivuranta

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 equipment 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 or with web learning.

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 three intermediate exams with potential web learning, lecture diary and/or homework. 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:

Elisa Koivuranta

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

Opettajat: Elisa Koivuranta

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 equipment and phenomena related to them. In addition, the student can explain application of unit processes and can describe their operational principles.

Contents:

Liquid and suspensions: 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 or with web learning.

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 three intermediate exams with potential web learning, lecture diary and/or homework. 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:

Elisa Koivuranta

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

Opettajat: Ahola, Juha Lennart

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:

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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

Opettajat: Ainassaari, Kaisu Maritta

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.

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:

The course 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 Kaisu Ainassaari

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

Opettajat: Hiltunen, Jukka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

477602A	Control System Analysis	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

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

Opettajat: Hiltunen, Jukka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

477603A	Control System Design	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

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:

-

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:

Spring periods 3 and 4.

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:

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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:

-

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

Opettajat: Ainassaari, Kaisu Maritta

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.

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:

The course 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 4 intermediate exams. The course can also be completed by final examination.

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:

-

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
Opettajat: Esko Juuso
Opintokohteen kielet: Finnish
Leikkaavuudet:

477503S	Simulation	3.0 op

ECTS Credits:

5 ECTS / 135 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

Opettajat: Aki Sorsa

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS /135 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:

Aki Sorsa

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 (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

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

Opettajat: Seppo Honkanen

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

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 477621A Control system analysis and 477622A Control system design recommended beforehand

Recommended optional programme components:

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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, 135 h of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

Timing:

Period 3

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 477621A Control system analysis, 477622A Control system design and 477624S Control system methods recommended beforehand

Recommended or required reading:

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

Assessment methods and criteria:

Exam and homework

Grading:

Numerical grading scale 1.5 or fail

Person responsible:

Professor Enso Ikonen

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

Opettajat: Esko Juuso

Opintokohteen kielet: Finnish

Leikkaavuudet:

477505S	Fuzzy-neuromethods in Process Automation	4.0 op

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

Finnish and English

Timing:

Implementation in the spring term, on the 3rd period. Recommended for 4th 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 25 ECTS

031080A: Signal Analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Kotila, Vesa Iisakki

Opintokohteen kielet: Finnish

Leikkaavuudet:

031050A	Signal Analysis	4.0 op

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

Finnish.
The course can be completed in English by a final exam or a retake exam.

Timing:

The course is held in the autumn semester, during period II. It is recommended to complete the course at the 2nd autumn semester.

Learning outcomes:

Upon completion of the course, the student:
-is able to calculate the energy, the power, the convolution and the frequency spectrum of discrete and analog, periodic and non-periodic deterministic signals
-is able to calculate the spectrum of a sampled signal
-is able to calculate the Hilbert transform and the complex envelope of a signal
-is able to study the stationarity, the mutual dependence and the frequency content of random signals by means of the auto- and cross-correlation functions, and the power- and cross-power spectral densities

-is able to study the effect of an LTI system on a signal

Contents:

Signals, classification, frequency. Fourier analysis, analog and digital signal, fast Fourier transform. LTI system. Hilbert transform. AM- FM- and PM-modulation. Random variable. Covariance matrix. Random signal. Stationarity, autocorrelation. Power spectral density. Random signal in LTI system. Signal estimation.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures 28 h / Exercises 14 h / Self-study privately or in a group 93 h. The independent work includes individual STACK-assignments as online work.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the courses 031078P Matrix Algebra, 031021P Probability and Mathematical Statistics and 031077P Complex Analysis.

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:

Lecture notes. Additional reading: Proakis, J.G., Manolakis, D.K.: Introduction to Digital Signal Pro-cessing. Shanmugan, K.S., Breipohl, A.M.: Random Signals, Detection, Estimation and Data Analysis.

Assessment methods and criteria:

The course is completed with a final exam or a retake exam. In addition to the final exam, STACK-assignments given during the course are part of the assessment. The assessment of the course is based on the learning outcomes of the course.

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:

Vesa Kotila

Working life cooperation:

-

Other information:

-

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 /135 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 Dynamics (previous Process Control Engineering I) or respective recommended beforehand

Recommended optional programme components:

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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

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:

Dr Aki Sorsa

Other information:

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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:

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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: Jari Ruuska

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /135 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:

Jari Ruuska

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

Opettajat: Jenö Kovács

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

Timing:

Period 3 (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 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

Working life cooperation:

No

Other information:

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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: Marko Paavola

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS /135 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:

Marko Paavola

Working life cooperation:

No

Other information:

-

477626S: Building Automation Project, 5 - 10 op

Voimassaolo: 01.09.2018 -

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

ECTS Credits:
5 or 10 ECTS
Language of instruction:
Finnish
Timing:
Autumn semester (5 ECTS) and Spring semester (10 ECTS)
Person responsible:
Jukka Hiltunen

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

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
Opettajat: Elisa Koivuranta
Opintokohteen kielet: English
Leikkaavuudet:

477104S	Chemical Processing of Biomasses	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 identify lignocellulosic raw material sources, their properties, their main components and utilization potential of components. The student also identifies 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 36 h, web learning and self-study 97 h. A part of the teaching can be replaced by group work or home work.

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 three intermediate exams with potential web learning, lecture diary and/or homework. 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:

Elisa Koivuranta

Working life cooperation:

A visit/excursion to the local pulp mill and/or visiting lecturers from the industry, when feasible.

Other information:

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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

Opettajat: Elisa Koivuranta

Opintokohteen kielet: English

Leikkaavuudet:

477105S	Mechanical Processing of Biomasses	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 34 h, web learning and self-study 99 h. A part of teaching can be replaced by group work or home work.

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 three intermediate exams with potential web learning, lecture diary and/or homework. 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:

Elisa Koivuranta

Working life cooperation:

Visiting lecturers from the industry and/or a visit/excursion to a local manufacturing site, when feasible.

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

Opettajat: Elisa Koivuranta

Opintokohteen kielet: English

Leikkaavuudet:

477128S	Circular Bioeconomy	5.0 op
477106S	Recycled Fiber Processes	3.0 op
477105S	Mechanical Processing of Biomasses	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 36 h, web learning and self-study 97 h. A part of the teaching can be replaced by group work or home work.

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 three intermediate exams with potential web learning, lecture diary and/or homework. 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:

Elisa Koivuranta

Working life cooperation:

Visiting lecturers from the industry, when feasible.

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

Opettajat: Elisa Koivuranta

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 with a written case-study.

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 identifies 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 (in Finnish) 42 h, a written case study as group work, which is presented to course participants, 40 h. Excursion to local paper mill and printing laboratory 3 h. Self-study 48 h.

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. Separate study material for the English book exam for foreign students.

Assessment methods and criteria:

End exam and written case-study.

Grading:

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

Person responsible:

Elisa Koivuranta

Working life cooperation:

Lecturer from the industry and an excursion to the local paper mill.

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

Opettajat: Elisa Koivuranta

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 or Finnish

Timing:

Implementation (registration) during autumn periods 1-2, completion throughout the year with mutual agreement.

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 possibly by oral presentation.

Target group:

Students interested in bioeconomy or circular economy.

Prerequisites and co-requisites:

Studies in the field of bioproduct technology or circular economy 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:

Elisa Koivuranta

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 and analysis equipment.

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

Opettajat: Petri Tervasmäki

Opintokohteen kielet: English

Leikkaavuudet:

488304S Bioreactor Technology 6.0 op

ECTS Credits:

5 ECTS /135 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 61 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. upplementary material: Villadsen J., Nielsen J., Liden G. Bioreactor engineering principles. Springer Verlag, 2011. Shuler ML., Kargi F. Bioprocess engineering basic consepts. 2nd ed. Pearson. 2002 and 2014.

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:

Petri Tervasmäki

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

Opintokohteen kielet: English

Leikkaavuudet:

480450S	Bioprocesses III	5.0 op

ECTS Credits:

5 ECTS /135 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. 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 51 h.

Target group:

Master students in bioprocess engineering. Master students in process engineering, environmental 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, exercises and 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:

Johanna Panula-Perälä

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: Ville-Hermanni Sotaniemi

Opintokohteen kielet: English

Leikkaavuudet:

488310S	Laboratory Course in Microbiology	2.0 op

ECTS Credits:

5 ECTS /135 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, if 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 28 h.

Target group:

Master’s students of bioprocess engineering.

Prerequisites and co-requisites:

Courses 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering, 488321S 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 and written report.

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:

-

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

Opettajat: Ville-Hermanni Sotaniemi

Opintokohteen kielet: Finnish

Leikkaavuudet:

488307S	Bioprocess Engineering	7.0 op

ECTS Credits:

5 ECTS /135 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. 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 and literature research 63h

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:

Dr Sanna Taskila

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 and Finnish

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 and workshops. 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, exchange 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:

Problem-based exercises and a final exam will count towards the final grade.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5/fail.

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 /135 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 Dynamics (previous Process Control Engineering I) or respective recommended beforehand

Recommended optional programme components:

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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

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:

Dr Aki Sorsa

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

Opettajat: Jani Kangas

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /135 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 46 h and self-study 87 h

Target group:

Students in the study options Process Design and Chemical Engineering

Prerequisites and co-requisites:

Essential contents of 477401A Thermodynamic equilibria course, or equivalent knowledge on the basic concepts of thermodynamic equilibria.

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:

Dr Jani Kangas

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: 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 477322A 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.
Oheiskirjallisuus: Walas, S.M.: Phase Equilibria in Chemical Engineering; Henley, E.J. & Seader, J. D.: Equilibrium-stage Separation Operations in Chemical Engineering.

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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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: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

470222A	Reactor Analysis and Design II	5.0 op

ECTS Credits:

5 ECTS / 135 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 ((i.e. multicomponent and multiphase 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 and computer simulations (CFD), face-to-face teaching.

Learning activities and teaching methods:

Lectures 30 h, exercises and simulation 14 h, homework 16 h, self-study 75 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:

Fogler, H. Scott: Elements of chemical reaction engineering. (5th edition) 2016. Prentice Hall PTR: Pearson Education International; Nauman, E.B.: Chemical Reactor Design. New York, John Wiley & Sons.1987;
Additional literature: Winterbottom, J.M. & King, M.B. (Editors) Reactor Design for Chemical Engineers. Padstow 1999, T.J. International Ltd. 442 s. 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:

Intermediate exams (2) or final 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:

University Lecturer Mika Huuhtanen

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: Jani Kangas, Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

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 and biochemicals 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 novel 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:

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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

Opettajat: Ahola, Juha Lennart

Opintokohteen kielet: English

Leikkaavuudet:

477206S	Advanced Process Design	6.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

Timing:

Spring, periods 3 and 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 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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A431238: Module of the Option/Chemical Engineering, 60 op

Voimassaolo: 01.08.2017 -

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

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: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

470222A	Reactor Analysis and Design II	5.0 op

ECTS Credits:

5 ECTS / 135 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 ((i.e. multicomponent and multiphase 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 and computer simulations (CFD), face-to-face teaching.

Learning activities and teaching methods:

Lectures 30 h, exercises and simulation 14 h, homework 16 h, self-study 75 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:

Fogler, H. Scott: Elements of chemical reaction engineering. (5th edition) 2016. Prentice Hall PTR: Pearson Education International; Nauman, E.B.: Chemical Reactor Design. New York, John Wiley & Sons. 1987;
Additional literature: Winterbottom, J.M. & King, M.B. (Editors) Reactor Design for Chemical Engineers. Padstow 1999, T.J. International Ltd. 442 s. 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:

Intermediate exams (2) or final 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:

University Lecturer Mika Huuhtanen

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

Opettajat: Satu Pitkäaho

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. Student is capable of specifying the process steps in catalyst design, selection and testing. Student 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 a catalyst and catalysis, history of catalysis, economical, social and environmental meaning. Kinetics and mechanisms of catalytic reactions. Catalyst materials and structure, characterization, design and preparation, and testing of catalysts. Catalysis in industry. Environmental catalysis.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 40 h, exercises 10 h, homework 20 h, teamwork presentations 10 h, and 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:

Postdoctoral researcher Satu Pitkäaho

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: Ainassaari, Kaisu Maritta
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 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 and visiting scientists.

Mode of delivery:

Face-to-face teaching and seminars.

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:

Docent Esa Muurinen

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

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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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: 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 477322A 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.
Oheiskirjallisuus: Walas, S.M.: Phase Equilibria in Chemical Engineering; Henley, E.J. & Seader, J.D.: Equilibrium-stage Separation Operations in Chemical Engineering.

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 / 135 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:

In the Finnish version: Lectures and compulsory exercise done in small groups. In the English version, compulsory simulation exercise done in small groups and a book exam, which replaces the lectures given in Finnish.

Learning activities and teaching methods:

Lectures 252h, and exercise 8 h, project work 10 h, self-study 93 h. For foreign students written examination based on given literature and a compulsory 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:

The course 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 simulation 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

Opettajat: Jani Kangas

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /135 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 46 h and self-study 87 h

Target group:

Students in the study options Process Design and Chemical Engineering

Prerequisites and co-requisites:

Essential contents of 477401A Thermodynamic equilibria course, or equivalent knowledge on the basic concepts of thermodynamic equilibria.

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:

Dr Jani Kangas

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 /135 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 46 h and group work 89 h

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

Opettajat: Aki Sorsa

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS /135 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:

Aki Sorsa

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

Opettajat: Ahola, Juha Lennart

Opintokohteen kielet: English

Leikkaavuudet:

477206S	Advanced Process Design	6.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

Timing:

Spring, periods 3 and 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 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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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: Jani Kangas, Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

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 and biochemicals 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 novel 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:

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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 /135 hours of work

Language of instruction:

English.

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

Prerequisites and co-requisites:

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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:

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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.

Choose 30 or 60 ECTS

477415S: Thermodynamic and process modelling in metallurgy, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: English

ECTS Credits:

5 cr / 135 hours of work.

Language of instruction:

English

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 can use computational methods (i.e. HSC Chemistry -software) to investigate the thermodynamic equilibria (e.g. in metallurgy and mineral processing). These thermodynamic considerations include 1) equilibrium calculations, 2) mass and heat balances as well as 3) phase diagrams. Additionally, they can use commercial process simulation software (i.e. HSC Sim -software) to model metallurgical processes. This means that the student will know how to 1) model flowsheets for various processes, 2) apply simulation in practical problems and 3) run calculation and analyse the results.

Contents:

Course is divided in two parts. Part I focuses on thermodynamic modelling in the contexts of metallurgy: How to use HSC Chemistry as well as its modules (Reaction equations, Equilbrium compositions, Heat & Material balances, H, S, CP, G diagrams, Stability diagrams, Eh-pH diagrams, Measure units, Periodic chart, Species converter) and database? How to define a system? How to interpret results? Part II focuses on general information and exercises in HSC-Sim (Flowsheet simulation -module): HSC-Sim structure and user interface, toolbar, drawing a flowsheets with HSC Sim, data necessary for building up a simulation in mineral processing, structure of HSC Sim Distribution mode, simulation of metallurgical balance.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Simulation exercises (work in pairs) supported by the contact-education, which consists of simulation exercises (48 hours). The rest is individual work outside the lectures.

Target group:

SStudents of process metallurgy.

Prerequisites and co-requisites:

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

Recommended optional programme components:

This course is one of the courses of pyrometallurgy in the module of process metallurgy.

Recommended or required reading:

Material will be distributed during the lectures and exercises. Each student is required to search additional material for the exercises when necessary.

Assessment methods and criteria:

Continuous assessment consisting of simulation exercises and reports based on the exercises. Work in pairs. No final exams are organized.

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:

The course includes guest lectures from the industry.

Other information:

Due to continuous assessment used in this course, it is highly recommended that the students are present already in the first lecture.

477416S: High temperature processes, 5 op

Voimassaolo: 28.11.2016 - 31.07.2022

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:

477427A High temperature processes 5.0 op

ay477416S High temperature processes (OPEN UNI) 5.0 op

ECTS Credits:

5 cr / 135 hours of work.

Language of instruction:

Finnish

Timing:

The course is held in the autumn semester, during period I. It is recommended to complete the course at the 4th autumn semester.

Learning outcomes:

SStudents passing the course are familiar with the metal production processes and metallurgical unit operations. Additionally, students know how to evaluate high temperature processes from different perspectives (energy and reductants, refractory materials, slags and ashes, waste and emissions as well as automation, measurements and modelling).

Contents:

The most important pyrometallurgical unit operations and other high temperature processes as well as things that need to be taken into account when considering high temperature processes (e.g. energy and reductants, refractory materials, slags and ashes, waste and emissions as well as automation, measurements and modelling).

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Lectures (approximately 45 hours) supporting the exercises that are made during the course. Only in Finnish.

Target group:

Students of process metallurgy.

Prerequisites and co-requisites:

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

Recommended optional programme components:

This course is one of the courses of pyrometallurgy in the module of process metallurgy.

Recommended or required reading:

Material will be distributed during lectures and exercises. It is also available via courses www-site. Each student is required to search additional material for the exercises when necessary.

Assessment methods and criteria:

Continuous assessment consisting of exercises that are made during the course. Please note that the course is organised only in Finnish.

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:

The course includes a seminar day organized together with industry.

Other information:

Due to continuous assessment used in this course, it is highly recommended that the students are present already in the first lecture.

477417S: High temperature chemistry, 5 op

Voimassaolo: 28.11.2016 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Eetu-Pekka Heikkinen
Opintokohteen kielet: Finnish

ECTS Credits:

5 cr / 135 hours of work.

Language of instruction:

Finnish

Timing:

The course is held in the autumn semester, during period 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 high temperature processes. Students can e.g. calculate thermodynamic equilibria, read and construct phase stability diagrams as well as estimate reaction rates and the effect of surface and interfacial phenomena on high temperature processes, etc.

Contents:

Models and methods that are used to investigate the chemical reactions in the research and development of high temperature processes. Contents are divided into five categories: 1. Compound and phase stabilities. 2. Thermodynamic modelling of pyrometallurgical solutions. 3. Reaction kinetics in high temperature systems. 4. Burning. 5. Interfacial phenomena.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Lectures (40 hours) supporting the exercises that are made during the course. Only in Finnish.

Target group:

Students of process metallurgy.

Prerequisites and co-requisites:

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

Recommended optional programme components:

This course is one of the courses of pyrometallurgy in the module of process metallurgy.

Recommended or required reading:

Material will be distributed during lectures and exercises. It is also available via courses www-site. Each student is required to search additional material for the exercises when necessary.

Assessment methods and criteria:

Continuous assessment consisting of exercises that are made during the course. Please note that the course is organised only in Finnish.

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:

There is no direct working life cooperation in this course.

Other information:

Due to continuous assessment used in this course, it is highly recommended that the students are present already in the first lecture.

477418S: Experimental methods of high temperature research, 10 op

Voimassaolo: 28.11.2016 - 31.07.2021

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Tanskanen

Opintokohteen kielet: Finnish

Leikkaavuudet:

477426S	Characterisation methods of inorganic materials	5.0 op

ECTS Credits:

10 cr / 270 hours of work.

Language of instruction:

Finnish

Timing:

The course is held 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 high temperature 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 high temperature 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 (96 hours) that supports these exercises.

Target group:

Students of process metallurgy.

Prerequisites and co-requisites:

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

Recommended optional programme components:

This course is one of the courses of pyrometallurgy in the module of process metallurgy.

Recommended or required reading:

Material will be distributed during lectures and exercises. It is also available via courses www-site. Each student is required to search additional material for the exercises when necessary.

Assessment methods and criteria:

Continuous assessment consisting of group-exercises and reports. Please note that the course is organized only in Finnish.

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:

The students implement a small R&D project in which genuine challenge or problem is studied.

Other information:

Due to continuous assessment used in this course, it is highly recommended that the students are present already in the first lecture. The amount of students participating in this course may be limited.

477419S: Seminar in metallurgy, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

ECTS Credits:

5 cr / 135 hours of work.

Language of instruction:

Finnish, English if necessary

Timing:

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

Learning outcomes:

Student can describe a metallurgical company and its production, evaluate one's own work and its role as well as prepare and give a written and oral seminar presentation.

Contents:

Course consists of seminar presentations prepared and given by students. Each student must prepare four presentations with topics based on their work experience in metallurgical industry or research institute. Topics are: 1. company presentation, 2. presentation of production chain, 3. description of student's own work at the company and 4. literature survey on the given topic.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Seminars (max. 32 h) for which students prepare presentations. Attendance in the seminars is mandatory. Presentations are prepared outside these classroom education hours.

Target group:

Students of process metallurgy.

Prerequisites and co-requisites:

Knowledge and skills corresponding the knowledge and skills that are obtained from the Bachelor-level-studies in the programme of process or environmental engineering as well as work experience (e.g.

summer training period) from metallurgical industry or research institute are recommended as prerequisities. In order to get credits from this course, bachelor thesis must be completed.

Recommended optional programme components:

This course is one of the courses of pyrometallurgy in the module of process metallurgy.

Recommended or required reading:

Students create the study materials themselves as a part of seminar work. This requires independent search of source material.

Assessment methods and criteria:

Students are required to prepare and give seminar presentations on given topics (written and oral).

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:

Seminar presentations within this course are based on students’ experience in industry and/or research organisations.

Other information:

Due to continuous assessment used in this course, it is highly recommended that the students are present already in the first lecture.

781649S: Sampling and Sample Pretreatment, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced 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. English on demand.

Timing:

4th or 5th spring. The course is lectured every other year, next time during the spring 2019.

Learning outcomes:

After this course student becomes aware of the importance of correct sampling (especially heterogeneous solid materials). The student also gets knowledge how to i) sample and ii) prepare samples for various types of analysis: determination of total element concentrations (incl. ultra trace levels), fractionation of elements and element speciation analysis. At the end of the course the students should have also acquired an understanding of the techniques that are used in sample preconcentration and matrix separation, as well as purification of reagents and laboratory tools when very low element concentrations are measured.

Contents:

Representative sampling and sampling errors, various sample preparation techniques utilizing open and closed systems and their use in the determination of total element concentrations in inorganic and organic sample types. Fusion techniques and fire assay methods. Sample preparation in trace element fractionation and speciation analysis. Systematic errors in analysis (losses and contamination), clean rooms, separation and preconcentration techniques.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

30 hours of lectures + seminar presentation + 104 hours of self-study

Target group:

Chemistry, optional

Prerequisites and co-requisites:

Introduction to Analytical Chemistry (780111P or 780119P)

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:

Sirén, H., Perämäki, P., Laiho, J.: Esikäsittelyn käsikirja, Kemian Kustannus Oy, 2009 and material handed out by the lecturer.

Assessment methods and criteria:

Final examination or home assignment.
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:

Paavo Perämäki

Working life cooperation:

No

Other information:

No

781657S: Experimental Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced 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. English on demand.

Timing:

4th or 5th spring. The course is lectured every other year, next time during the spring 2020.

Learning outcomes:

After this course student becomes aware of importance experimental design and is able to apply most common experimental designs in the field of chemistry.

Contents:

Factorial designs, mixture designs, D-optimal designs, response surface methodology. Computer programmes are applied during the course in the design and analysis of experiments.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

30 hours of lectures and exercises + 104 hours of self-study incl. computer aided analysis of experimental data.

Target group:

Chemistry, optional

Prerequisites and co-requisites:

Metrological Fundamentals of Analytical Chemistry (781651S)

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:

Montgomery, D.C.: Design and Analysis of Experiments, 8th ed., John Wiley & Sons.
Massart, D.L., Vandeginste, B.G.M., Buydens, L.M.C., De Jong, S., Lewi, P.J. and Smeyers-Verbeke, J.: Handbook of Chemometrics and Qualimetrics: Part A, Elsevier, 1997, partly.

Assessment methods and criteria:

Final examination or home assignment
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:

Paavo Perämäki

Working life cooperation:

No

Other information:

No

782640S: Chemistry of Hydrometallurgical Processes, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced 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, English on demand

Timing:

4th or 5th spring. The course is lectured every other year, next time during the spring 2017.

Learning outcomes:

Upon completion of the course, the student will be able to explain chemical principles of hydrometallurgical processes and phenomena. The student knows the most important chemical reactions and variables affecting hydrometallurgical processes. Process chemistry is significant in several industrial applications, and those applications are considered during the course.

Contents:

Introduction to hydrometallurgical processes, pre-treatment of concentrates (oxidation, heat treatment), principles of dissolution (including leaching and bioleaching) and purification, chemical precipitation and other metals recovery processes (extraction, ion-exchange), electrical processes and process chemistry (electrolysis, corrosion).

Mode of delivery:

Face-to-face teaching and seminars

Learning activities and teaching methods:

40 hours of lectures, 10 hours of seminars, 84 hours of self study

Target group:

Chemistry, optional

Prerequisites and co-requisites:

Physical Chemistry I and Physical Chemistry II

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:

Lecture notes (in English).

Assessment methods and criteria:

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:

Ulla Lassi

Working life cooperation:

No

Other information:

No

782638S: Chemistry in Industrial Applications, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Chemistry

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

782338A	Chemistry in Industrial Applications	5.0 op
ay782638S	Chemistry in Industrial Applications (OPEN UNI)	5.0 op

ECTS Credits:

5 credits / 134 hours of work

Language of instruction:

Finnish/English on demand

Timing:

4th or 5th spring. The course is lectured every other year, next time during the spring 2018.

Learning outcomes:

Upon completion of the course, the student will be able to explain several chemical applications in process and environmental technology. In particular, the student knows the novel applications in which chemistry is used.

Contents:

Catalytic applications in water purification, catalytic oxidation, preparation of biofuels from biomass, biomass gasification and the utilisation of biogas, chemistry and chemical reactions in mining processes etc. (visiting lecturers from the companies)

Mode of delivery:

Face-to-face teaching and seminars

Learning activities and teaching methods:

40 hours of lectures, 10 hours of seminars, 84 hours of self-study

Target group:

Chemistry, optional

Prerequisites and co-requisites:

Physical Chemistry I and Physical Chemistry II

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:

Material given by the lecturer, scientific review papers

Assessment methods and criteria:

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:

Ulla Lassi

Working life cooperation:

No

Other information:

No

782637S: Surface Chemistry, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced 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/English on demand

Timing:

4th or 5th autumn. The course is lectured every other year, next time during the autumn 2017.

Learning outcomes:

Upon completion of the course, the student will be able to explain the essential phenomena of surface chemistry, such as surface tension, interfaces and surface reactions. The student knows the properties of liquid surfaces and interfaces, and the role of surface active agents. The student will be able to explain properties of surfaces and surface phenomena. The student knows the most important surface structures and methods used in surface science studies. Surface phenomena are significant in several industrial applications, and those applications are theoretically studied during the course.

Contents:

Properties of liquid-gas, liquid-liquid, solid-gas and solid-liquid interfaces. Surface structures, Surface phenomena and Surface analytical methods. A wide range of applications are considered on molecular level, such as emulsions, foams, flotation, nucleation, surface active agents.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

5O hours of lectures, 84 hours of self-study

Target group:

Chemistry, optional

Prerequisites and co-requisites:

Physical Chemistry I and Physical Chemistry II

Recommended optional programme components:

Previous courses Surface Chemistry I and Surface Chemistry II

Recommended or required reading:

Adamson, A.W.: Physical Chemistry of Surfaces, 6. painos, John Wiley & Sons, New York, 1997 (partly); Somorjai, G.A.: Introduction to Surface Chemistry and Catalysis, John Wiley & Sons, New York, 1994 (partly). Final examination is based on the lectures.

Assessment methods and criteria:

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:

Ulla Lassi

Working life cooperation:

No

Other information:

No

782639S: Electrochemistry, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced 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/English on demand

Timing:

4th or 5th autumn. The course is lectured every other year, next time during the autumn 2018.

Learning outcomes:

Upon completion of the course, the student will be able to explain the essential phenomena of electrochemistry, such as electrochemical reactions, electrolytes and related thermodynamics. The student knows the principle of electrochemical cells (batteries and fuel cells) and kinetics of electrochemical reactions. These phenomena are significant in chemical and metal industry, such as in metal recovery by electrolysis.

Contents:

Introduction to electrochemistry, electrochemical reactions and reaction kinetics, electrolytes and thermodynamics of electrolytic solutions, electrochemical cells (batteries and fuel cells), measurement methods of electrochemical properties, applications of electrochemistry.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

50 hours of lectures, 84 hours of self study

Target group:

Chemistry, optional

Prerequisites and co-requisites:

Physical Chemistry I and Physical Chemistry II

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:

Murtomäki, L., Kallio, T., Lahtinen, R. & Kontturi, K.: Sähkökemia, 2. painos, Korpijyvä Oy, Jyväskylä, 2010; Bockris, J.O´M., Reddy, A.K.N.: Modern Electrochemistry, vol 1, 2. painos, Plenum Press, New York, 1988, partly, lecture notes. Examination based on the lectures.

Assessment methods and criteria:

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:

Ulla Lassi

Working life cooperation:

No

Other information:

No

780670S: Special Lecture, 0 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Chemistry
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Ei opintojaksokuvauksia.

A431239: Module of the Option/ Energy Systems and Cleaner Production, 60 op

Voimassaolo: 01.08.2017 -
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

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: Jani Kangas, Tanskanen, Juha Petri
Opintokohteen kielet: Finnish
Leikkaavuudet:

477208S Biorefineries 3.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

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 and biochemicals 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 novel 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

Opettajat: Satu Pitkäaho

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. Student is capable of specifying the process steps in catalyst design, selection and testing. Student 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 a catalyst and catalysis, history of catalysis, economical, social and environmental meaning. Kinetics and mechanisms of catalytic reactions. Catalyst materials and structure, characterization, design and preparation, and testing of catalysts. Catalysis in industry. Environmental catalysis.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 40 h, exercises 10 h, homework 20 h, teamwork presentations 10 h, and 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:

Postdoctoral researcher Satu Pitkäaho

Working life cooperation:

No

Other information:

-

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

Opettajat: Väisänen, Virpi Maria

Opintokohteen kielet: English

Leikkaavuudet:

488402A	Sustainable Development	3.0 op

ECTS Credits:

5 cr / 133 hours of work

Language of instruction:

English

Timing:

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 4 h / student presentations (guided group work), discussions, opponency 26 h / court case simulation 5 h / home work 98 h.

Target group:

Master’s students of environmental engineering, especially of international master’s programmes such as the Master's Degree Programme in Environmental Engineering

Prerequisites and co-requisites:

For Environmental Engineering 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 and learning diary. Compulsory requirements are presence on at least 80% of face-to-face lectures, participation in the group works, presenting own presentation and acting as an opponent to another presentation.

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

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 / 135 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 30 h / Self-study 75 h. The exercises are completed as guided 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:

-

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 / 135 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 95 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 or 477013P Introduction to Process and Environmental Engineering 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:

-

Choose the other

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) Starting research work: research types, funding, the process of research work, finding the research area, choosing the research topic, information sources. 2) 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. 3) Reporting: writing a scientific text, referring, plagiarism, writing scientific theses and reports. 4) Other issues connected to research work: ethical issues, integrity, and future. 5) 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.

488143S: Environmental Impact Assessment, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannu Marttila

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course is held in the autumn semester during the 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 and project work

Learning activities and teaching methods:

The amount of lecture hours can varied depending teaching resources in every year but independent project working is the main activities in the course. Work load in the course is totally 133 h. The project work is completed as group work.

Target group:

Only master students in Water resources and environmental engineering major in the Environmental Engineering Master Program

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 assignment (60 %) and seminar (40%). More information about assessment methods 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:

Docent Hannu Marttila

Working life cooperation:

The course includes the guest lectures from local companies and authorities. The assignment is based on case studies that are rael on-going or passed EIA projects.

Other information:

Maximum number of the students in the course is 20.

Choose Energy Systems or Cleaner Production

H432232: Module of the Option/Energy Systems, 30 op

Voimassaolo: 01.08.2017 -

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

488501S: Smart Grid I: Integrating renewable energy sources, 5 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Eva Pongracz
Opintokohteen kielet: English

ECTS Credits:

5 cr/150 hours of work

Language of instruction:

English

Timing:

Period 2

Learning outcomes:

The student is able to explain the concept of smart grids, the evolution of smart grids from electricity power grids, the information technology requirements as well as the economic, environmental and social implications of smart grids. The student will know the expectations from smart grids and is able to outline the future perspectives of smart grid-based energy systems.

Contents:

Multidisciplinary course, offered in cooperation of the Faculty of Technology (Energy and Environmental Engineering Research Unit - EEE), Oulu Business School (OBS, Department of Economics) and the Faculty of Information Technology and Electrical Engineering (Centre of Wireless Communication - CWC). After an introductory presentation on the requirements, the background is set on the energy and environmental crisis, the co-evolution of energy and information systems and outlining the transition to a smarter system. Further, lectures on smart grids will be provided from an electrical engineering and information technology view on the evolution of electricity power grids, power generation transmission and distribution; distributed generation and futures of smart grids. From an environmental engineering point of view, lectures will be delivered on energy systems fundamentals, climate goals and decarbonization, as well as on the sustainability of smart grids will in particular the environmental and social impacts of smart grids. From economics points of view, lectures will be given on the liberalization and deregulation of the electricity market, electricity pricing, transmission and distribution as natural monopolies, smart grids and new market mechanisms, and the economic impacts of large scale integration of renewable energy sources. Participation on lectures is not compulsory, but students are to answer to problem questions. As an exercise, students will be given a group work assignment that they are to work with throughout the duration of the course with the help of mentors. The subjects of the exercise is achieving climate goals and the future of energy systems.

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 32 h / student presentations 8 h, Guided group work: 8 h, individual homework 60 h/group work 42 h.

Target group:

Master's students of environmental engineering, especially of energy and environmental engineering orientation; Master's students in economics; Master's students of Electrical Engineering and Information Technology.

Prerequisites and co-requisites:

For Environmental Engineering students, admission to the Master's programme, for which minimally a former bachelor's degree is required. For other students the Bachelor level studies. A minimum of 10 ECTS worth of prior energy studies, bachelor level studies are acceptable. For example at Oulu: Sähkö- ja magnetismioppi, Production and use of energy, Fundamentals of nuclear energy.

Recommended or required reading:

Will be provided during the course by the lecturers.
Chen-Ching Liu, Stephern McArthur and Seung-Jae Lee (eds.)(2016) Smart Grids handbook, 3 volume set, and Stephen F. Bush (2014): Smart Grid: Communication-Enabled Intelligence for the Electric Power Grid. http://onlinelibrary.wiley.com/book/10.1002/9781118820216.

Assessment methods and criteria:

Answering problem questions and group exercise. Compulsory requirements are completing learning portfolio, answering of at least 75% of problem questions, participation in 50% of intermediate presentations and compulsory participation in the final presentation.

Grading:

The course evaluation will be based on an on-line learning portfolio and performance in the exercise participation and exercise report. The course unit utilizes a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.

Person responsible:

Docent Eva Pongrácz (EEE) and Prof. Maria Kopsakangas-Savolainen (OBS). Other lecturers: EEE: Dr. Antonio Caló, Dr. Jean-Nicolas Louis; OBS: Prof. Rauli Svento, Mari Heikkinen, Hannu Huuki, Santtu Karhinen, Enni Ruokamo; CWC: Dr. Pedro Nardelli.

Other information:

The number of students is limited. This course is a 5 credit course for engineering students, but economics students gain overall 6 credits by doing a mandatory extra assignment which corresponds to 1 credit.

488502S: Smart Grid II: Smart buildings/smart customers in the smart grid, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eva Pongracz

Opintokohteen kielet: English

ECTS Credits:

5 cr/150 hours of work

Language of instruction:

English

Timing:

Period 3

Learning outcomes:

The student is able to explain the concept of smart houses, and is able to demonstrate the optimization of smart house functions for energy efficiency, decarbonization and cost savings. Further, the student is familiar with the concepts and the technologies of smart house automation as well as other technologies used in smart houses such as smart appliances, smart metering and energy storage. The student will also understand the new role of consumers in the smart grid environment, their changing roles as well as current and future models of energy services. The student will also understand the risks of smart houses in terms of cyber security, data privacy and management. In addition, the student is able to outline the future perspectives of smart houses and smart consumers as part of the smart city framework and aiming toward eco-cities of the future.

Contents:

Multidisciplinary course, offered in cooperation of the Faculty of Technology (Energy and Environmental Engineering Research Unit - EEE), Oulu Business School (OBS, Department of

Economics) and the Faculty of Information Technology and Electrical Engineering (Centre of Wireless Communication - CWC). After an introductory presentation on the course requirements, the basics are set in terms of defining smart houses as part of smart grids. Further the complementary roles of smart houses for energy efficiency, costs saving and decarbonization is explained. The key technologies of smart houses will be explained and demonstrated, including company presentations on existing commercial technologies and service models. In addition, the new role of consumers as prosumers and service users will be explained and demonstrated. There will be no exam, however, the students are to answer to problem questions related to the lectures and complete the exercises. There will be 4 exercises, concentrating on the 4 key themes of the course: smart house functions, smart house technologies, smart consumers, and energy services. Part of the exercises will be done as individual work that will be reported and some will be performed as group work. There will also be in-class guided exercises.

Mode of delivery:

Implemented as face-to-face teaching, visiting lectures and student presentations. The course largely relies on participatory learning, therefore, there are compulsory participation requirements.

Learning activities and teaching methods:

Lectures 28 h, student presentations 4 h, guided exercise work 24 h, individual work 50 h, group work 38 h.

Target group:

Master's students of environmental engineering, especially of energy and environmental engineering orientation; Master's students in economics; Master's students of Electrical Engineering and Information Technology. Doctoral students are also welcome to participate.

Prerequisites and co-requisites:

Completing Smart grids 1 course is preferred.

Recommended or required reading:

Will be provided during the course by the lecturers.
Chen-Ching Liu, Stephern McArthur and Seung-Jae Lee (eds.)(2016) Smart Grids handbook, 3 volume set, and Stephen F. Bush (2014): Smart Grid: Communication-Enabled Intelligence for the Electric Power Grid. http://onlinelibrary.wiley.com/book/10.1002/9781118820216.

Assessment methods and criteria:

Answering problem questions, individual and group exercise. Compulsory requirements are completing learning portfolio, answering of at least 75% of problem questions, compulsory participation in the in-course exercises and participation in the student presentation.

Grading:

The course evaluation will be based on an on-line learning portfolio, exercise performance and exercise report. The course unit utilizes a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.

Person responsible:

Prof. Eva Pongrácz (EEE) and Prof. Maria Kopsakangas-Savolainen (OBS). Other lecturers: EEE: Dr. Jean-Nicolas Louis; Dr. Antonio Caló, OBS: Prof. Rauli Svento, Santtu Karhinen...; CWC: Dr. Pedro Nardelli, Dr. Jussi Haapola, MSc. Florian Kühlenz.

Other information:

The number of students is limited. This course is a 5 credit course for engineering students, but economics students gain overall 6 credits by doing a mandatory extra assignment which corresponds to 1 credit.

488503S: Smart Grid III: Smart energy networks, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eva Pongracz

Opintokohteen kielet: English

ECTS Credits:

5 cr/135 hours of work

Language of instruction:

English

Timing:

Spring, period 4

Learning outcomes:

The student is able to explain the concept of energy transition, and is able to outline the structure and functioning of smart energy networks. Further, the student is familiar with the concepts of multi-vector energy networks, networks flow analysis, integration and synergy of multiple energy networks and. The student will also understand the concept of swarms of distributed energy generation and the need for storage to ensure network stability. The student will also able to outline the key energy storage methods and will be able to recommend them for distributed vs. centralized storage of both heat and electricity, for long term as well as short term. The student will also be able to use design tools for the planning and evaluation of future energy systems. The student will also be able to assess the dimensions of sustainability of smart energy networks.

Contents:

Multidisciplinary course, offered in cooperation of the Faculty of Technology (Energy and Environmental Engineering Research Unit - EEE), Oulu Business School (OBS, Department of Economics) and the Faculty of Information Technology and Electrical Engineering (Centre of Wireless Communication - CWC). After an introductory presentation on the course requirements, the basics are set in terms of defining energy transition to a carbon neutral energy future. Further the integration of multiple energy networks will be explained, as well as communication within multiple energy networks. The issue of swarms of distributed generation will be explained, as well as the economics of a system relying largely on renewables. The key storage technologies will be explained, demonstrating their use for heat or electricity storage, their effectiveness on small or large scale, as well as their purpose and economics of short and long term storage. Communication within the smart grid as well the economics of distributed generation in a future carbon neutral energy system will be explained. Finally, the sustainability assessment of smart energy network performance will be explained.
There will be no exam, however, the students will need to answer to problem questions related to the lectures and complete exercises. There will be 3 exercises, concentrating on (1) evaluation of storage technologies, (2) simulation of future smart energy networks and (3) sustainability assessment. The simulation work will be done as group work using the HOMER Energy software, for which in-class guidance will be provided. The results of the simulation will have to be presented. The rest will be done as individual work.

Mode of delivery:

Implemented as face-to-face teaching, visiting lectures and student presentations. The course largely relies on participatory learning, therefore, there are compulsory participation requirements.

Learning activities and teaching methods:

Lectures 28 h, student presentations 4 h, guided exercise work 24 h, individual work 50 h, group work 38 h.

Target group:

Master’s students of environmental engineering, especially of energy and environmental engineering orientation; Master’s students in economics; Master’s students of Electrical Engineering and Information Technology. Doctoral students are also welcome to participate.

Prerequisites and co-requisites:

Completing the course 488501S is a prerequisite, completing the course 488502S prior to this course is also recommended.

Recommended or required reading:

Will be provided during the course by the lecturers.
Chen-Ching Liu, Stephern McArthur and Seung-Jae Lee (eds.)(2016) Smart Grids handbook, 3 volume set, and Stephen F. Bush (2014): Smart Grid: Communication-Enabled Intelligence for the Electric Power Grid. http://onlinelibrary.wiley.com/book/10.1002/9781118820216.

Assessment methods and criteria:

Answering problem questions, individual and group exercise. Compulsory requirements are completing learning portfolio, answering of at least 75% of problem questions, compulsory participation in the in-course exercises and participation in the student presentation.

Grading:

The course evaluation will be based on an on-line learning portfolio, exercise performance and exercise report. The course unit utilizes a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.

Person responsible:

Prof. Eva Pongrácz (WE3) and Prof. Maria Kopsakangas-Savolainen (OBS). Other lecturers: WE3: Dr. Antonio Caló, Dr. Jean-Nicolas Louis; OBS: Enni Ruokamo; CWC: Doc. Jussi Haapola

Other information:

The number of students is limited. This course is a 5 credit course for engineering students, but economics students gain overall 6 credits by doing a mandatory extra assignment which corresponds to 1 credit.

488504S: Fundamentals of nuclear energy, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Antonio Calo

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits

Language of instruction:

English

Timing:

Autumn semester during the 1st period.

Learning outcomes:

Upon completion of the course, students can define the basic elements of nuclear power production and technology. They are thus able to describe the physical processes as well as the different components of a nuclear power plant. Students can also describe different elements of nuclear power technology deployment such as safety, environmental and health related issues.

Contents:

Basics of nuclear physics, fission and fusion; introduction to nuclear power technology and components of a nuclear power plant; history of nuclear power production; nuclear fuel cycle, mining and uranium extraction, enrichment, fuel temporary and permanent disposal; introduction to nuclear power plant design, safety and auxiliary system design; principles of nuclear safety and strategy of accidents prevention and management; principles of health physics, monitoring safety and prevention; introduction to nuclear power safety and safety culture.

Mode of delivery:

lectures

Learning activities and teaching methods:

Lectures 36h; mandatory work assignment and written final exam.

Target group:

Second year Master degree students; the course is open to all interested doctoral students.

Recommended or required reading:

lecture slides and information on recommended reading material will be provided during the course

Assessment methods and criteria:

Written final exam.

Grading:

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

Person responsible:

University researcher Antonio Caló

Other information:

The course will include a number of guest lecturers' contributions. When needed, lectures will happen through video conference. There might be the possibility for students located somewhere other than Oulu to attend the course via video conference as well. Such eventualities will have to be discussed and pre-arranged with the course organizers.

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 / 135 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during 3 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

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:

-

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

Opettajat: Jenö Kovács

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

Timing:

Period 3 (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 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

Working life cooperation:

No

Other information:

-

H432233: Module of the Option/Cleaner Production, 30 op

Voimassaolo: 01.08.2017 -

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

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: Tiina Laitinen, Esa-Matti Turpeinen, 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 / 135 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 nd period.

Learning outcomes:

Student is able to explain what kind of air emissions originate from certain industries and power plants, and can explain their effects on environment and health. He/she can describe how air emissions are measured. Student is also aware of common air pollution control systems for different emissions (particulates, VOCs, SO2, NOx) and is able to design air pollution cleaning devices. In addition, the student is able to describe the main laws related to air emission control.

Contents:

Atmosphere and air pollutants. Air pollution effects and regulations. Emission measurements. General ideas in air pollution control. Emission control technologies; primary particulates, VOC emissions, SOx emissions, NOx emissions. Motor vehicle problem, CO, lead, HAP, Indoor air pollution, and radon.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h, exercises 12 h, homework 8 h, teamwork presentations 10 h, and self-study 75.

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 (or 477013P Introduction to Process and Environmental Engineering) 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 or intermediate exams.
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:

Postdoctoral researcher Satu Pitkäaho

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

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 / 135 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,...) 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. 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 beforehand.

Recommended optional programme components:

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Recommended or required reading:

Material represented in lectures and in the Optima environment.

Assessment methods and criteria:

Written final exam or 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:

Doctoral student Niina Koivikko

Working life cooperation:

No

Other information:

The course mainly consists of specific lectures presented by experts who are invited from industry.

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

Opettajat: Ahola, Juha Lennart

Opintokohteen kielet: English

Leikkaavuudet:

477206S	Advanced Process Design	6.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

Timing:

Spring, periods 3 and 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 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:

-

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 /135 hours of work

Language of instruction:

English.

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

Prerequisites and co-requisites:

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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:

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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: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

470222A	Reactor Analysis and Design II	5.0 op

ECTS Credits:

5 ECTS / 135 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 ((i.e. multicomponent and multiphase 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 and computer simulations (CFD), face-to-face teaching.

Learning activities and teaching methods:

Lectures 30 h, exercises and simulation 14 h, homework 16 h, self-study 75 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:

Fogler, H. Scott: Elements of chemical reaction engineering. (5th edition) 2016. Prentice Hall PTR: Pearson Education International; Nauman, E.B.: Chemical Reactor Design. New York, John Wiley & Sons.1987;
Additional literature: Winterbottom, J.M. & King, M.B. (Editors) Reactor Design for Chemical Engineers. Padstow 1999, T.J. International Ltd. 442 s. 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:

Intermediate exams (2) or final 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:

University Lecturer Mika Huuhtanen

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.

Choose the other, Courses only every second year

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

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: Ainassaari, Kaisu Maritta

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 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 and visiting scientists.

Mode of delivery:

Face-to-face teaching and seminars.

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:

Docent Esa Muurinen

Working life cooperation:

No

Other information:

-

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.

Compolsory

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 credits/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 behind the most used purification processes in water and wastewater treatment. The student will also be capable of performing basic dimensioning calculations and therefore he/she will be able to dimension structures/units of water and wastewater treatment plants and to comprehend the basic requirements of different purification processes.

Contents:

Water quality characteristics of source water; basic principles of purification processes (coagulation/flocculation, sedimentation, biological treatment, filtration, disinfection, etc); process units in water and waste water treatment; selection of process units; dimensioning of treatment structures and unit processes.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (30 h), field visits (5 h), exercises and other assignments (60) and self-study (38 h).

Target group:

Students in Master program of Environmental Engineering and in master program of civil 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 (477013P) or I (477011P) and II (488010P)

Recommended optional programme components:

-

Recommended or required reading:

To be provided during the course.

Assessment methods and criteria:

The course can be completed in two different study modes: A) Active mode: midterm exam based on reading material + completion of 2 group exercises + final exam based on lectures and exercises; B) Passive mode (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. (Passive mode can be complete under special circunstances)
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:

Post-doctoral researcher Dr Elisangela Heiderscheidt

Working life cooperation:

Through visits to water and wastewater treatment plants, which include lectures provided by environmental engineers in charge and guided tours, the students familiarize with the main technological and process related principles of the field and have the chance to experience in first hand how to deal with some of the most common issues related to water and wastewater purification systems.

Other information:

-

488134S: Hydrogeology and groundwater engineering, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the spring semester, during period 3

Learning outcomes:

Upon completion of the course, the student will have knowledge on groundwater systems and the basic hydrogeological and engineering concepts involved. This includes analysis of flow in porous media, hydraulics of groundwater systems, groundwater quality and groundwater use. After the course students are able to estimate key factors influencing on groundwater recharge, flow and discharge and to use general methods to calculate groundwater flow.

Contents:

2D and 3D groundwater flow, conceptual models, unsaturated layer flow, water storage and retention, heterogeneity and isotropy, aquifer types, pumping tests, geophysical methods, groundwater quality and resources in Finland

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

lectures (18 h), calculus lectures (12 h), homework, exercises and self-study (103 h).

Target group:

Master students in the water engineering orientation of the Environmental Engineering program and in master program of civil engineering

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 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:

exam and/or lecture exams.

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:

Students familiarize themselves to a real groundwater aquifer cases discussed in lectures and in the course exercise.

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

Opettajat: Ali Torabi Haghighi

Opintokohteen kielet: English

Leikkaavuudet:

488118S	Laboratory Exercises and Field Measurements in Environmental Engineering	10.0 op

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, levelling, map and scale, different tests in soil mechanics laboratory.
Laboratory works in soil mechanics and geotechnical engineering: sieving test, hydrometer test, Atterberg limits test, proctor test, direct shear box test and oedometer test.
In the field: Working with GPS. Levelling and collecting data for preparing topography map. Soil sampling, surface water and groundwater sampling, Measuring velocity and discharge of river by using current meter and tracer.

Mode of delivery:

Face-to-face teaching, laboratory working

Learning activities and teaching methods:

Lectures (16 h), Fieldwork (20 h), Lab-work (9 h), Group work (88 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:

Two exams (40%), Report (50%) and assignments (10%), passing the exam is requirement for passing 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 Teacher Ali Torabi Haghighi

Working life cooperation:

No

Other information:

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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

Opettajat: Ali Torabi Haghighi

Opintokohteen kielet: English

Leikkaavuudet:

488118S	Laboratory Exercises and Field Measurements in Environmental Engineering	10.0 op

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:

Lectures (10 h), Lab-work (30 h), Group work (93 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

Other information:

-

488135S: Water distribution and sewage networks, 5 op

Voimassaolo: 28.11.2016 - 31.07.2019

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: English

Leikkaavuudet:

488144A	Water distribution and sewage networks	5.0 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, in period 2

Learning outcomes:

Student knows and understands the systems and dynamics needed for water distribution and waste water networks. Student is able to do basic dimensioning for water distribution network and sewer system of an urban area.

Contents:

Water distribution and waste water network design and dimensioning, Pumping and storage tanks needed in distribution of water and collection of sewage waters, renovation of pipelines, special circumstances in water distribution, effects of cold climate and harmful hydraulic conditions.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (30 h), homework (45 h) and a design exercise (58 h).

Target group:

Students in master program of environmental engineering and in master program of civil engineering

Prerequisites and co-requisites:

Use of AutoCAD-program

Recommended optional programme components:

The recommended prerequisite is the completion of the following course prior to enrolling for the course unit: 477052A Virtaustekniikka, 477312A Lämmön- ja aineensiirto 488102A Hydrological Processes and 488051A AutoCAD ja Matlab prosessi- ja ympäristötekniikan työkaluna or at least equivalent information about water management.

Recommended or required reading:

Lecture handout and other materials delivered in lectures. To the appropriate extent: RIL 237-1-2010 Vesihuoltoverkkojen suunnittelu, RIL 237-2-2010 Vesihuoltoverkkojen suunnittelu, RIL 124-2 Vesihuolto II, Mays Water distribution systems handbook

Assessment methods and criteria:

Exam and a design exercise.

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:

Visit to a site of water distribution network buiding site, pumping station or water supply/sewerage company.

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: Anssi Rauhala

Opintokohteen kielet: Finnish

Leikkaavuudet:

485306S	Geoenvironmental Engineering	5.0 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

Finnish and option complete in English

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 technique for 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, Structures of dams and inpoundments, Challenges of mining, Remote sensing as a part of geotechnical applications.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (44 h), group work (60 h) and independent work (31 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 (substitute: researcher Anssi Rauhala)

Working life cooperation:

The course includes a visit to the Rusko waste center and also guest lectures from professionals in industry and administration.

Other information:

-

488136S: Integrated water resources management, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, in period 1

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 in nordic and global perspectives.

Contents:

Different water uses and interests, hydropower and dam engineering, irrigation and drainage, flood control and management, restoration cases, sedimentation problems, land use management, water protection, optimization and simulation, socio-ecological aspects in water resources.

Mode of delivery:

Face-to-face teaching, assignments, exam

Learning activities and teaching methods:

Variable learning methods: Lectures, assignments, exam

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 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: More detailed instructions will be given in the course.

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:

The course includes the real life examples from Water Resources Management issues.

Other information:

The course is arranged in alternate years (odd years in the autumn semester).

Choose Water or Geo Engineering

H432234: Module of the Option/Water Engineering, 25 op

Voimassaolo: 01.08.2017 -

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.

Choose 25 ECTS

488137S: Statistical hydrology, 5 op

Voimassaolo: 28.11.2016 - 31.07.2020
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Hannu Marttila
Opintokohteen kielet: English
Leikkaavuudet:

488145S	Data analysis for Water Resources	5.0 op

ECTS Credits:

5 ECTS credits/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 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))

Grading:

Final grade of the course is average of assignments and final exam. In the numerical scale zero stands for a fail.

Person responsible:

Postdoctoral Researcher Pertti Ala-aho

Working life cooperation:

The course includes handling of real data and handling of typical problems in water engineering

Other information:

The course is arranged in alternate years (odd years in the autumn semester).

488138S: Cold climate hydrology, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Anna-Kaisa Ronkanen

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course is held in the autumn semester during the period 2

Learning outcomes:

After completing the course, the students had deepened their knowledge on processes effecting snow accumulation, melt and runoff. They are able to use computational methods to study runoff-rainfall processes and are able to apply isotope hydrological tools in e.g. hydrograph separation and calculate age of groundwater. Furthermore they deepen their knowledge in hydrological analysis of hydrological pathways, evapotranspiration, infiltration to frozen ground, temporal and spatial variability of climate and hydrology.

Contents:

Hydrological processes, evapotranspiration, climate variability and extreme events, rainfall-runoff modeling, snow hydrology, soil frost and ice, environmental tracer hydrology, isotope hydrology.

Mode of delivery:

Face-to-face teaching and independent work with assignments.

Learning activities and teaching methods:

Lectures 18 h / independent process studies, modelling and homeworks 115 h. Totally 133 h.

Target group:

Master students in Water resources and environmental engineering major in the Environmental Engineering Master 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 hydrology

Recommended or required reading:

Delivered 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

Other information:

The course is arranged in alternate years (even years in the autumn semester).

488139S: Surface water quality modelling, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Anna-Kaisa Ronkanen

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course is held in the autumn semester during the period 2

Learning outcomes:

After completing the course, the students are able to estimate point and diffusion load from catchment to lakes or rivers and are familiar with basic limnology of these water systems. The students are also able to analyse water systems using mathematical modelling and understand main pollutant transport mechanisms so that are able to model water quality in lakes and streams. They also understand key concepts of surface water systems, and how to control nutrient and pollutant processes. The students are able to use Matlab in environmental analysis, modeling and programming.

Contents:

Modelling in water resources planning, environmental hydraulics, open channel flow, diffusive and point loading, limnology, processes and water quality, dimensional analysis, hydraulic experiments, transport of conservative and reactive solutes in water bodies. 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 26 h / guided exercises by Matlab 16 h / self-studies 91 h. Totally 133 h.

Target group:

Master students in Water resources and environmental engineering major in the Environmental Engineering Master 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 the exam and assignments.

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

Other information:

The course is arranged in alternate years (even years in the autumn semester).

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 software, River stability and flood control structure, Conveyance structures, Water storage structures, Protective structures, Regulating structures, Water measurement structures, Energy Dissipaters, Design small hydraulic structures

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (24 h), group work (36 h), independent work (29 h), self-study (29 h) and seminar (15 h)

Target group:

Students in Master programs of environmental engineering and civil engineering

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the following course or having corresponding knowledge prior to enrolling for the course unit: 477052A Fluid mechanics and 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:

Technical project (Using Hec-Ras for flood control Project) (30%), assignment (15%), river engineering report (15%), two exams (50%).
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 arranged in alternate years (even years in the autumn semester).

488140S: Groundwater modelling and management, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pertti Ala-Aho

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the spring semester, during period 4

Learning outcomes:

Upon completing the course, the student is able to analyze and model groundwater systems and considering various apects of management. The student is familiar with basic groundwater modelling concepts and tools. From different groundwater case studies, students will gain knowledge on ecological, social and economic aspects of groundwater management.

Contents:

Grid based modelling, solute transport, model uncertainties, groundwater management questions, groundwater dependent ecosystems, groundwater and cold climate

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (20 h), modelling work (25 h) and self-study and report (88 h).

Target group:

Master students in the water engineering orientation 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: 488134S Hydrogeology and groundwater engineering, 031022P Numerical Methods

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, report and presentation for project work.

Grading:

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

Person responsible:

Postdoctoral Researcher Pertti Ala-aho

Working life cooperation:

Students get experience on modeling software used in the consulting industry, and familiarize themselves to complex real-life groundwater management cases.

488143S: Environmental Impact Assessment, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannu Marttila

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course is held in the autumn semester during the 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 and project work

Learning activities and teaching methods:

The amount of lecture hours can varied depending teaching resources in every year but independent project working is the main activities in the course. Work load in the course is totally 133 h. The project work is completed as group work.

Target group:

Only master students in Water resources and environmental engineering major in the Environmental Engineering Master Program

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 assignment (60 %) and seminar (40%). More information about assessment methods 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:

Docent Hannu Marttila

Working life cooperation:

The course includes the guest lectures from local companies and authorities. The assignment is based on case studies that are rael on-going or passed EIA projects.

Other information:

Maximum number of the students in the course is 20.

488141S: Urban hydrology, 5 op

Voimassaolo: 28.11.2016 - 31.07.2020

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: English

Leikkaavuudet:

488146S	Urban water management	5.0 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the spring semester, in period 3

Learning outcomes:

Student has a knowledge on the different aspects of urban hydrology to manage waters in a built environment. Student understands the challenges concerning quantity and quality questions of urban waters and can take them into account in designing.

Contents:

Storm water system design, green infrastructure, urban erosion, drainage, flood control and climate change in urban hydrology, urban water quality and constructed wetlands.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (30 h), homeworks (45 h) and a design exercise (58 h).

Target group:

Students in master program of environmental engineering and in master program of civil engineering

Prerequisites and co-requisites:

Use of AutoCAD-programs. This course is a straight continuation of course 488135A Water distribution and sewage networks (recommended but not prerequisite prior to this course).

Recommended optional programme components:

The recommended prerequisite is the completion of the following course prior to enrolling for the course unit: 477052A Fluid mechanics, 477312A Lämmön- ja aineensiirto 488102A Hydrological Processes and 488051A AutoCAD ja Matlab prosessi- ja ympäristötekniikan työkaluna or at least equivalent information about water management.

Recommended or required reading:

Lecture handouts, Hulevesiopas (2012, in Finnish)

Assessment methods and criteria:

Examination, seminar and a design exercise.

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:

Course includes guest lectures of storm water designers/consultants and/or municipalities/cities responsible for the storm water management.

H432235: Module of the Option/Geo Engineering, 25 op

Voimassaolo: 01.08.2017 -

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.

Choose 25 ECTS

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

Opettajat: Anssi Rauhala

Opintokohteen kielet: Finnish

Leikkaavuudet:

485305S	Modelling in Geoenvironmental Engineering	5.0 op

ECTS Credits:

5 ECTS credits/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. Geotechnical design of pile foundation.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (10 h), design (58 h) and modelling assignments (65 h).

Target group:

Master's students in the study option of Water and Geoenvironmental Engineering

Prerequisites and co-requisites:

The required prerequisite: 488115A Geomechanics. Also recommended: 488051A AutoCAD and Matlab in Process and Environmental Engineering, 488121S Fundamentals of Civil Engineering, 488129S Foundation Engineering, 488131S Geoenvironmental Engineering.

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout and other materials delivered in lectures

Assessment methods and criteria:

Passing the course requires solving the given assignments and writing reports about them. The assignments are solved with computer modelling, which requires constant participation to the lectures.

Grading:

The course utilizes verbal grading scale pass/fail.

Person responsible:

University teacher Anne Tuomela (substitute: researcher Anssi Rauhala)

Working life cooperation:

The course includes guest lectures from an international consulting and engineering company.

Other information:

-

488129S: Foundation Engineering, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Veikko Pekkala

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay485302A	Foundation Engineering (OPEN UNI)	5.0 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

5 ECTS credits / 132 hours of work

Timing:

The course unit is held in the autumn semester during period 2

Learning outcomes:

After completing the course, students can choose the right foundation type and design shallow and deep foundations. After completing the course the student is also able to design earth retaining structures, drainage and frost protection.

Contents:

The following topics are covered during the course: The basis of geotechnical and structural design of foundations. Foundation types and foundation construction. Piles and piled foundations. Ground bearing slabs. Gravity and embedded walls. Ground improvement. Drainage. Frost protection.

Mode of delivery:

Lecture room teaching.

Learning activities and teaching methods:

Lectures and exercises

Target group:

Master's students of environmental and civil engineering

Prerequisites and co-requisites:

Recommend course 488115A Geomechanics

Recommended or required reading:

1. Lecture material.
2. RIL 254-2016, Paalutusohje
3. RIL 263-2014 Kaivanto-ohje
4. Decoding Eurocode 7 (2008), Bond, A. and Harris, A., Taylor & Francis, (Contents are informed during lectures).

Assessment methods and criteria:

Passed practical works and exam

Grading:

Rating scale 1-5

Person responsible:

Researcher Veikko Pekkala

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: Anssi Rauhala

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits/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, soil improvement, excavations, Property and surface drainage, lowering of groundwater table. Pipeline Construction. Specialities of railway construction and vibration problems.

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 (91 h)

Target group:

Master students in the Water and Geo Engineering study option of the Environmental Engineering program

Prerequisites and co-requisites:

Prerequisites: 488115A Geomechanics, 477032A AutoCAD and Matlab in process and environmental engineering (or similar AutoCAD knowledge)

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:

University teacher Anne Tuomela (substitute: researcher Anssi Rauhala)

Working life cooperation:

The course includes guest lectures from various sectors of civil engineering.

Other information:

-

488140S: Groundwater modelling and management, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pertti Ala-Aho

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the spring semester, during period 4

Learning outcomes:

Upon completing the course, the student is able to analyze and model groundwater systems and considering various apects of management. The student is familiar with basic groundwater modelling concepts and tools. From different groundwater case studies, students will gain knowledge on ecological, social and economic aspects of groundwater management.

Contents:

Grid based modelling, solute transport, model uncertainties, groundwater management questions, groundwater dependent ecosystems, groundwater and cold climate

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (20 h), modelling work (25 h) and self-study and report (88 h).

Target group:

Master students in the water engineering orientation 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: 488134S Hydrogeology and groundwater engineering, 031022P Numerical Methods

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, report and presentation for project work.

Grading:

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

Person responsible:

Postdoctoral Researcher Pertti Ala-aho

Working life cooperation:

Students get experience on modeling software used in the consulting industry, and familiarize themselves to complex real-life groundwater management cases.

488141S: Urban hydrology, 5 op

Voimassaolo: 28.11.2016 - 31.07.2020

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: English

Leikkaavuudet:

488146S	Urban water management	5.0 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the spring semester, in period 3

Learning outcomes:

Student has a knowledge on the different aspects of urban hydrology to manage waters in a built environment. Student understands the challenges concerning quantity and quality questions of urban waters and can take them into account in designing.

Contents:

Storm water system design, green infrastructure, urban erosion, drainage, flood control and climate change in urban hydrology, urban water quality and constructed wetlands.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (30 h), homeworks (45 h) and a design exercise (58 h).

Target group:

Students in master program of environmental engineering and in master program of civil engineering

Prerequisites and co-requisites:

Use of AutoCAD-programs. This course is a straight continuation of course 488135A Water distribution and sewage networks (recommended but not prerequisite prior to this course).

Recommended optional programme components:

The recommended prerequisite is the completion of the following course prior to enrolling for the course unit: 477052A Fluid mechanics, 477312A Lämmön- ja aineensiirto 488102A Hydrological Processes and 488051A AutoCAD ja Matlab prosessi- ja ympäristötekniikan työkaluna or at least equivalent information about water management.

Recommended or required reading:

Lecture handouts, Hulevesiopas (2012, in Finnish)

Assessment methods and criteria:

Examination, seminar and a design exercise.

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:

Course includes guest lectures of storm water designers/consultants and/or municipalities/cities responsible for the storm water management.

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

Opettajat: Hiltunen, Jukka Antero

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 (**=** min. 2 months working full-time)
Language of instruction:
Finnish or English
Timing:
Student usually works during the summer time between the 1st and 2nd academic year of the Master's degree.
Learning outcomes:
The objective is to get a deeper and more detailed conception of the industrial area where the student will possibly work after graduation. After the advanced practical training working period, the student is able to tell about their potential future jobs either in a new position or in an already familiar work environment. The student is able to identify and solve problems in work environment. Students are able to apply the theoretical knowledge they have learned in practical tasks. The student recognizes the diploma engineer's duties from his or her workplace.
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:
Practical training (internship) is usually carried out as a regular employee, to prepare the student for his/her possible future tasks in a leading, guiding, and/or planning position. In addition the student will be in touch with practical work and occupational safety issues, as well as the individual and social nature of the workplace. In addition to the training, the student is also required to prepare a CV and give a seminar presentation on his/her training.
Learning activities and teaching methods:
Students must 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, e.g. supervision tasks and R&D tasks.
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 as an employee (of minimally 2 months of full time work), and giving an oral seminar presentation to report the summer job. Student also has to show his/her original references (job certificates) and his/her cv, and submit an application form to the supervisor of the seminar. The reference must include the training period (from - to) and the duties. Advanced practical training cannot be substituted with jobs the student has performed before his/her Master's studies.
Grading:
Verbal scale Passed/Failed
Person responsible:
Jukka Hiltunen
Working life cooperation:
Yes
Other information:
-

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.

Compulsory; this module is suitable for the students of Processmetallurgy either advanced or supplementary module

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

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

ECTS Credits:

5 ects/135 hours study time

Language of instruction:

Finnish

Timing:

Lectures and laboratory works, 3 and 4 periods

Learning outcomes:

The aim of the course is to introduce the common physical (metallurgical) phenomena in metal alloys and other construction materials. He/she understands the effect of different microstructural features on the mechanical properites and the processibility of the above mentioned materials. Finally, he/she is familiar with typical non-destructive and destructive testing techniques in material science.

Contents:

Solidification and phase transformations, plastic deformation, static recovery and recrystallization, effect of microstructure on mechanical properties of metal alloys, typical corrosion mechanisms, fatigue in metal alloys, creep in metal alloys, and non-destructive and destructive material testing.

Mode of delivery:

Face-to face teaching

Learning activities and teaching methods:

32 hours lectures/ 12 hours laboratory exercises/91 hours indepedent studies. Three laboratory excersises are included in the course.

Prerequisites and co-requisites:

None

Recommended or required reading:

Lecture booklet (In Finnish). Other material will be announced at the beginning of the course.

Assessment methods and criteria:

Final exam. The final grade is based on the final exam.

Grading:

Numerical grading scale 1 - 5. Laboratory exercises will be graded as "pass"/"fail".

Person responsible:

Olli Nousiainen

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

Opettajat: Anna Kisko

Opintokohteen kielet: Finnish

Language of instruction:

Finnish

Timing:

Lectures and materials selection exercise take place during the periods 1 and 2, autumn term.

Learning outcomes:

The objective of the course is to familiarize the student with basic matters concerning properties of metallic and non-metallic structural materials, the area within which the materials are in use, and the principles of materials selection. After the course, the student is able to classify different structural materials such as steels, cast irons, non-ferrous metals, polymer based materials and structural ceramics. The student masters structural materials and their selection so that he/she is able to select the most proper structural material for a product or component.

Contents:

Common structural materials in mechanical engineering, including steels (structural, QT, tool, stainless), cast irons, non-ferrous metal alloys (aluminium, titanium, magnesium, copper, nickel) and polymer based materials (structural plastics, plastics composite, elastomers, rubbers). Materials selection taking into account different demands. Ashby diagrams.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

The course is made up of lectures (32 h) and a materials selection exercise in small group during the periods 1 and 2.

Prerequisites and co-requisites:

Reommended: 465101A Introduction to Materials for Mechanical Engineering.

Recommended or required reading:

Lecture booklet (in Finnish); Exercise materials

Assessment methods and criteria:

The final grade is based on the combined points from materials selection exercise (0,2) and exam (0,8).

Grading:

Numerical grading scale 1-5 / fail.

Person responsible:

Olli Nousiainen

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

ECTS Credits:

5 ects/ 135 hours study time

Language of instruction:

Finnish

Timing:

Lectures and laboratory works, 1. period

Learning outcomes:

The aim of the course is to introduce common crystal structures in metal alloys. A student knows how to describe crystal planes and crystal directions of a cubic crystal structure using Miller indices. He/she also understands the interactions between x-ray radiation (or electronic beam) and metallic specimen. Finally, he /she is able to analyze data obtained from XRD, SEM/EBSD and TEM studies.

Contents:

Crystal strucrture, bonding types, reciprocal lattice, XRD, SEM/EBSD, and TEM.

Mode of delivery:

Face-to face teaching

Learning activities and teaching methods:

32 hours lectures/ 12 hours laboratory exercises/91 hours independent studies. Three laboratory excersises are included in the course.

Prerequisites and co-requisites:

465101A Introduction to materials for mechanical engineering and 465102A Materials for mechanical engineering.

Recommended or required reading:

Lecture booklet (In Finnish). Other material will be announced at the beginning of the course.

Assessment methods and criteria:

Final exam and final report. The final grade is based on the combined points from the exam (factor 0.7) and the report (factor 0.3).

Grading:

Numerical grading scale 1 - 5.

Person responsible:

Olli Nousiainen

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: Jukka Kömi

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

ECTS Credits:

5 ECTS/135 h study time

Language of instruction:

Finnish

Timing:

Autumn semester period 1. Recommended for 5 th year of studies.

Learning outcomes:

After completion of the course, the student will be able to list the main production stages in the steel production and name the most important factors affecting steel quality. (S)he will be able to explain the metallurgical phenomena involved in heat treatments and thermomechanical treatments, especially those concerned with grain refinement. (S)he will be able to name important steel types and describe their main properties and development trends. (S)he will be able to explain the factors that affect the formation of inclusions and the effects of inclusions on steel properties.

Contents:

Production of liquid steel, ladle treatments, continuous casting, rolling. Heat treatment and thermomechanical treatments and their effects on properties. Dynamic restoration mechanisms. Different steel types, their properties and applications. Inclusions and their effects on toughness, fatigue strength, machinability and surface quality.

Mode of delivery:

Face to face

Learning activities and teaching methods:

Lectures 32 h / independent study 103 h.

Target group:

Compulsory in the master's stage for all Mechanical Engineering students majoring in Materials Engineering.

Prerequisites and co-requisites:

Before registering for this course the student must have successfully completed the following courses: 465101A An Introduction to Materials for Mechanical Engineering, 465102A Materials for Mechanical Engineering, 465107A An Introduction to Physical Metallurgy.

Recommended or required reading:

Study guide and lecture presentations.

Assessment methods and criteria:

Final grade assessed on the basis of a final examination.

Grading:

Pass grades on a scale of 1-5. Grade 0 fail.

Person responsible:

Professor Jukka Kömi

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: Anna Kisko

Opintokohteen kielet: Finnish

Leikkaavuudet:

465075A	Research Techniques for Materials	3.5 op

ECTS Credits:

5 ects/ 135 hours study time

Language of instruction:

Finnish

Timing:

Lectures and laboratory works, 2. period

Learning outcomes:

This course gives an introduction to the broad spectrum of experimental techniques used in materials research, excluding materials testing. The principles, advantages and limitations of the various methods and their field of applications are described. Upon completing of the required coursework, the student can explain the structure, functioning and contrast formation as well as factors affecting the resolution of various metal microscopes. He/she is also able to explain the concepts of the thermal analysis, dilatometry, and magnetic and electrical measurements and list typical applications for these techniques and methods.

Contents:

Optical microscopy, scanning electron microscope (SEM), microanalysis techniques (EDS and WDS), atom force microscopy, dilatometry, thermal analysis techniques, magnetic measurement techniques, surface analysis techniques, and bulk analysis techniques.

Mode of delivery:

Face-to face teaching

Learning activities and teaching methods:

32 hours lectures/ 12 hours laboratory exercises/91 hours independent studies. Three laboratory excersises are included in the course.

Recommended or required reading:

Lecture booklet (In Finnish). Other material will be announced at the beginning of the course.

Assessment methods and criteria:

Lecture booklet (In Finnish). Other material will be announced at the beginning of the course.

Grading:

Numerical grading scale 1 - 5

Person responsible:

Olli Nousiainen

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: Jukka Kömi

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

Assessment methods and criteria:

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

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: Jukka Kömi

Opintokohteen kielet: Finnish

Leikkaavuudet:

465110S	Strength of metallic alloys	7.0 op
465081S	Physical Metallurgy I	7.0 op

Assessment methods and criteria:

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

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: Timo Kauppi

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

ECTS Credits:

8 cr / study time 216 h

Language of instruction:

Finnish

Timing:

Lectures (48 h) during the period 3, laboratory exercise continues during the period 4.

Learning outcomes:

The course gives essential background information on the phenomena taking place in welding and their influence on microstructures and mechanical properties and also provides skills in select materials and welding methods. Learning outcomes: Upon completing of the required coursework, student is able to:
-explain the influence of welding conditions on temperature distribution and solidification morphology of a welded joint,
-classify typical microstructures present in the heat-affected zone of low carbon steel weldments,
-compare the importance of microstructure on mechanical properties of the joint, and
-explain the microstructure changes occurring in welding of alloyed steels, cast irons and non-ferrous metals and their influence on properties.
After the course the student also has skills to select a proper weldability test for estimating the risk of cold and hot cracking.

Contents:

Heat distribution in welded joints; Solidification and segregation; Microstructures of the heat-affected zone; Weldability: structural steels, low-alloyed steels, stainless steels, cast irons, nonferrous metals; Welding defects and weldability testing.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

This course consists of 48 hours of lectures during the 3rd period, a seminar and a laboratory exercise with reporting.

Prerequisites and co-requisites:

465104A Heat treatment and welding of metals

Recommended or required reading:

Lecture notes (mainly in Finnish). Kou, S.: Welding Metallurgy, Wiley Co, New York 1987. Easterling K.: Introduction to the Physical Metallurgy of Welding, Butterworths & Co Ltd, London, 1983 Kyröläinen A ja Lukkari J., Ruostumattomat teräkset ja näiden hitsaus, MET, 1999

Assessment methods and criteria:

The final exam or midterm exams and the final grade is based on the exam (weight 0,8) and an exercise report (weight 0,2).

Grading:

Numerical grading scale 1-5.

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

Opintokohteen kielet: Finnish

Leikkaavuudet:

465079S	Failure Analysis	3.5 op

ECTS Credits:

5 ECTS/135 h study time

Language of instruction:

Finnish

Timing:

Spring semester, period 4. Recommended for fourth year of studies.

Learning outcomes:

After completion of the course, the student will be able to explain the effects of mechanical and environmental loads on the possible failure mechanisms in alloys. (S)he will be able to avoid unsuitable choices of materials in various applications. (S)he will be able to list the stages involved in a typical failure analysis. The student will be able to determine the most likely failure mechanism on the basis of the macroscopic and microscopic features of fracture surfaces. (S)he will be able to give rational instructions for avoiding failures. (S)he will be able to plan tests to measure fatigue and creep resistance.

Contents:

Failure mechanisms at low and high temperatures under static and dynamic loading. Failures caused by corrosion. Macroscopic and microscopic features of fracture surfaces. General principles and approaches to failure analysis. Practical examples of failure cases. Fatigue and creep testing.

Mode of delivery:

Face to face

Learning activities and teaching methods:

Lectures 32 h / independent study 103 h.

Target group:

Compulsory in the masters stage for all Mechanical Engineering students majoring in Materials Engineering.

Prerequisites and co-requisites:

Before registering for this course the student must have successfully completed the following courses: 465101A An Introduction to Materials for Mechanical Engineering, 465102A Materials for Mechanical Engineering, 465107A An Introduction to Physical Metallurgy.

Recommended or required reading:

Study guide and lecture slides. Additional material: Wulpi, D.J.: Understanding How Components Fail, ASM 1985. Engel L. and Klingele H.: Atlas of Metals Damage, Carl Hauser Verlag.

Assessment methods and criteria:

Final grade assessed on the basis of final examination.

Grading:

Pass grades on a scale of 1-5. Grade 0 fail.

Person responsible:

Professor Jukka Kömi

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

ECTS Credits:

10 ects/270 hours study time

Language of instruction:

Finnish

Timing:

Lectures and laboratory works, I and II periods

Learning outcomes:

The target for the course is for the student to gain knowledge of the basic concepts of the rolling technology, the basic character of the rolling process and some special characteristics also which are related to it. Upon completing the required coursework, the student can explain the effects of hot rolling and cold rolling on the quality of the final product. With the help of the learned theory, the student can explain the significance of the process modeling on the control of the rolling process. Furthermore, the student understands the connection between rolling and materials engineering and can estimate their effect on the manufacturing process and on the quality of the final product.

Contents:

Concepts of the rolling technology and terminology; Basics of the plasticity theory; Calculation of roll force and characteristics of roll gap; Temperature behavior during rolling; Flatness and profile analysis; Accuracy of manufacturing and its statistical applications; Modeling of the rolling process.

Mode of delivery:

Face-to face teaching

Learning activities and teaching methods:

50 hours lectures/ 30 hours laboratory exercises/190 hours independent studies. Three laboratory excersises are included in the course.

Recommended or required reading:

Lecture booklet (In Finnish). Starling: Theory and practise of flat rolling

Assessment methods and criteria:

Final exam.

Grading:

Numerical grading scale 1 - 5.

Person responsible:

Jussi Paavola

A432257: Supplementary Module, Traffic Engineering, 5 - 60 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Electives

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:

-

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

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

Other information:

-

A432258: Supplementary Module, Structural Engineering, 5 - 60 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Supplementary Module

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Electives

461102A: Statics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Lahtinen, Hannu Tapio

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay461102A	Statics (OPEN UNI)	5.0 op
461016A-01	Statics, examination	0.0 op
461016A-02	Statics, exercises	0.0 op
461016A	Statics	5.0 op

ECTS Credits:

5 ETCS / 149 hours of work

Language of instruction:

Lectures in finnish, foreign students follow the course by reading independently the books in english and taking part to the exercises and exams where all material is given in english.

Timing:

The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 1st autumn semester.

Learning outcomes:

After the course, the student can calculate forces and moments of loaded structures using equations of vector algebra and trigonometry. He/she can draw a free body diagram of the force system and then solve the unknown forces by using equations of equilibrium. He/she can determine resultants from uniformly distributed loads and apply Coulomb's law of friction in the problem equilibrium. The student can solve problems of internal and external forces of particle systems and rigid body systems in case of static equilibrium. Especially, he/she can draw shear force and bending moment diagrams for beam structures.

Contents:

Fundamental laws and concepts in statics. Force systems and their treatment. Equilibrium of particles and rigid bodies. Static forces in isostatic structures such as beams, frames, cables and trusses. Friction.

Mode of delivery:

Implemented as Face-to-face -teaching.

Learning activities and teaching methods:

Lectures 55 h / exercises 42 h / independent work of solving homework problems 52 h.

Target group:

Compulsory for candidate degree students of mechanical engineering programme.

Prerequisites and co-requisites:

Now prerequisites required.

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:

Salmi, T.: Statiikka, Pressus Oy, Tampere 2005; Beer, F., Johnston, R.: Vector Mechanics for Engineers, Statics, McGraw-Hill Book Company, 1996.

Assessment methods and criteria:

In the course acceptable homework and midterm exams / final exam are required. This course utilizes continuous assessment. There are four midterm exams, of which the last one is at the same time a final exam. Homework contain every week three problems that are marked. The student is allowed to participate to a final exam, when the homework is accepted.

Grading:

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

Person responsible:

University teacher Hannu Lahtinen

Other information:

The course gives ability for understanding static equilibrium, ability for determining force balance in structures and readiness for later studies.

461103A: Strength of materials I, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Lahtinen, Hannu Tapio

Opintokohteen kielet: Finnish

Leikkaavuudet:

461010A-01	Strength of Materials I, examination	0.0 op
461010A-02	Strength of Materials I, exercises	0.0 op
461010A	Strength of Materials I	7.0 op

ECTS Credits:

5 ETCS / 149 hours of work

Language of instruction:

Lectures in Finnish, foreign students follow the course by reading independently the books in English and taking part to the exercises and exams where all material is given in English.

Timing:

The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 1st spring semester.

Learning outcomes:

After the course, the student can determine stresses and strains of structures under loading. He/she can change the general stress and strain states from one coordinate system to another and can also apply constitutive equations in calculations. The student can dimension typical structures such as tension and compression bars, torsion bars and straight beams.

Contents:

Purpose and goals of strength of materials. Experimental elastic properties and strength of steel. Tension and compression of straight bars. Round torsion bar under shear force and torsion loads. Stresses and deflection curves in straight beams under bending moments. Stress state, strain state and constitutive equations, principal stresses, Mohr's circle. Stress hypotheses.

Mode of delivery:

Implemented as Face-to-face -teaching.

Learning activities and teaching methods:

Lectures 55 h / exercises 42 h / independent work of solving homework problems 52 h.

Target group:

Compulsory for Bachelor's degree students of mechanical engineering programme.

Prerequisites and co-requisites:

The recommended preceding course is 461102A Statics.

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:

Salmi, T., Pajunen, S.: Lujuusoppi, Pressus Oy, Tampere, 2010, Pennala, E.: Lujuusopin perusteet, Moniste 407, Otatieto 2002; Karhunen, J. & al.: Lujuusoppi, Otatieto 2004; Beer, F., Johnston, E., Mechanics of materials , McGraw-Hill, 2011; Gere, J.M., Timoshenko, S.P., Mechanics of Materials, Chapman&Hall, 1991.

Assessment methods and criteria:

In the course acceptable homework and midterm exams / final exam are required. This course utilizes continuous assessment. There are four midterm exams, of which the last one is at the same time a final exam. Homework contain every week three problems that are marked. The student is allowed to participate to a final exam, when the homework is accepted.

Grading:

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

Person responsible:

University teacher Hannu Lahtinen

Other information:

The course looks into the most important principal concepts of strenght of materials and gives ability for dimensioning of simple structures such as straight bars in tension, compression or torsion loads and straight beams under bending moments.

466101A: Introduction to building construction, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Liedes, Hannu Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

485101A	Introduction to building construction	5.0 op
460116A-01	Introduction to Contruction Engineering, examination	0.0 op
460116A-02	Introduction to Contruction Engineering, exercise work	0.0 op
460116A	Introduction to Building Construction	3.0 op

ECTS Credits:

5 ECTS credits / 132 hours of work

Language of instruction:

Finnish

Timing:

Spring, periods 3-4

Learning outcomes:

After completing the course students can describe the construction process, different parties of a construction project and their role in the project. Students can also explain how laws and legislation affects the construction, design and production of building structures. They can describe the material properties of the most common construction materials. They can also explain the certification process of a building material or product and the environmental legislation in construction.

Contents:

The following topics are covered during the course: Construction law and legislation. Different phases of a construction project. The raw materials, production and properties of the most common construction materials and products. Quality assurance and certification of building products. Environmental declarations. Life cycle assessment.

Mode of delivery:

Lecture room teaching.

Learning activities and teaching methods:

Lectures and exercises

Target group:

Students studying structural engineering

Recommended or required reading:

Lecture material. Land use and building legislation. The National Building Code of Finland

Assessment methods and criteria:

Passed practical works and exam

Grading:

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

Person responsible:

University teacher Hannu Liedes

466107S: Design of concrete structures, 6 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Antti Niemi

Opintokohteen kielet: Finnish

Leikkaavuudet:

485106A	Design of concrete structures	5.0 op
460147A	Introduction to Design of Concrete Technology	4.0 op
460147A-01	Introduction to Design of Concrete Technology, examination	0.0 op
460147A-02	Introduction to Design of Concrete Technology, exercise work	0.0 op
460148S	Design of Concrete Structures	4.0 op
460148S-01	Design of Concrete Structures I, examination	0.0 op
460148S-02	Design of Concrete Structures I, exercises	0.0 op

ECTS Credits:

6 ECTS /162 hours

Language of instruction:

Finnish

Timing:

Lectures and exercising on periods 3 and 4.

Learning outcomes:

Upon completion of the course, the student will be able to design typical reinforced concrete structures to EN-standards.

Contents:

Strength and strain properties of concrete and reinforcing bars, time dependent properties. Limit state design of concrete beams and columns to EN standards. Service life design. Fire design. Anchoring and joints of reinforcing bars. Design of flanged cross sections, walls and wall like beams, and foundations carrying walls and columns.

Mode of delivery:

face-to-face teaching.

Learning activities and teaching methods:

Lectures and exercising 54 hours including personal and team work. Self-reliant studying and homework 108 hours.

Target group:

Master level students focusing on structural engineering and design.

Prerequisites and co-requisites:

Recommended good skills in: Statics, strength of materials, structural mechanics of beam and plated structures. Basics in concrete technology and structural design.

Recommended or required reading:

Nykyri: BY211 Betonirakenteiden suunnittelun oppikirja, osa 1, 2013 ja osa 2, 2015; Leskelä: By210 Betonirakenteiden suunnittelu ja mitoitus 2008; By60 Suunnitteluohje EC2 osat 1-1 ja 1-2, 2008; EN 1992-1-1, EN 1992-1-2 (ja muut EN-standardit tarvittavilta osin); BY51 Betonirakenteiden käyttöikäsuunnittelu 2007; BY47 Betonirakentamisen laatuohjeet 2007; RIL 229-2-2006 Rakennesuunnittelun asiakirjaohje, Mallipiirustukset ja -laskelmat; By47 Betonirakentamisen laatuohjeet 2007; RIL202-2012 Betonirakenteiden suunnitteluohje. Martin, Purkiss: Concrete design to EN 1992, Elsevier, 2nd ed. 2006. Lecture and exercise materials.

Assessment methods and criteria:

Continuous assessment. The course can be completed by participating in intermediate exams during the course, or in final exam. Assessment criteria are based on the learning outcomes of the course.

Grading:

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

Person responsible:

university teacher Raimo Hannila, LSc (tech.)

466109S: Concrete technology, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jorma Hopia

Opintokohteen kielet: Finnish

Leikkaavuudet:

485105A Concrete technology 5.0 op

460155S-01 Concrete Technology, examination 0.0 op

460155S-02 Concrete Technology, laboratory exercise 0.0 op

460155S Concrete Technology 4.5 op

ECTS Credits:

5 ECTS credits / 132 hours of work

Language of instruction:

Finnish

Timing:

Spring semester, periods 3-4

Learning outcomes:

After completing the course the student is able to specify concrete and the materials from which it is made. They can design normal concrete mixes and identify, describe and carry out the main laboratory tests relevant to the use of concrete on site.

Contents:

Cements and cementitious materials, aggregates for concrete, concrete mix design, properties of fresh and hardened concrete, laboratory tests, specification testing and compliance, environmental exposure classes.

Mode of delivery:

Face-to-face and distance learning

Learning activities and teaching methods:

Lectures, excercises, case studies, laboratory sessions and self directed learning

Target group:

Students studying structural engineering

Prerequisites and co-requisites:

466101A Introduction to building construction

Recommended optional programme components:

466101A Introduction to building construction

Recommended or required reading:

The material that is in English will be distributed at the lectures. Lecture notes (mainly in Finnish), 1) Luennoilla jaettu materiaali 2) Järvinen, Maarit. 2004. Betonitekniikan oppikirja : BY 201. Helsinki : Suomen Betonitieto.; 3) Suomen betoniyhdistys. Betoninormit 2004: BY 50. Helsinki : Suomen betonitieto; 4) Suomen Standardisoimisliitto ry. SFS-Standardisointi: 5) SFS-EN Standards

Assessment methods and criteria:

Passed laboratory excercises and exam

Grading:

Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:

Raimo Hannila

461107A: Finite Element Methods I, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Lumijärvi, Jouko Veikko Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

461033A	Finite Element Methods I	3.5 op
461033A-01	Finite Element Methods I, examination	0.0 op
461033A-02	Finite Element Methods I, exercises	0.0 op

ECTS Credits:

5 ECTS credits / 132 hours of work

Language of instruction:

Finnish

Timing:

Lectures and exercises, periods 1. - 2.

Learning outcomes:

The aim of this course is for students to gain an understanding of the basic idea and restrictions of FEM. After this course, the student can explain the basic idea of the FEM. He/she can analyze simple truss-, frame- and plane structures and explain the theoretical background of the calculations.

Contents:

The basic idea of FEM and its use in static analyses of bars, beams and plane structures. Some general principles of the use of FEM.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures and exercises take place during periods 1.-2. The course can be passed either by completing two midterm exams or a final exam.

Prerequisites and co-requisites:

Strength of Materials I and II.

Recommended or required reading:

Lecture notes (in Finnish), N. Ottosen & H. Petersson: Introduction to the Finite Element Method, NAFEMS: A Finite Element Primer, O. C. Zienkiewcz & R. L. Taylor: The Finite Element Method, 4th ed, Vol. 1: Basic Formulation and Linear Problems.

Assessment methods and criteria:

The grade of the course is based on midterm exams or a final exam. The student must pass the exercises before taking the examination.

Grading:

Numerical grading scale 1-5.

Person responsible:

Jouko Lumijärvi

461106A: Dynamics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Koivurova Hannu

Opintokohteen kielet: Finnish

Leikkaavuudet:

461018A-01	Dynamics, examination	0.0 op
461018A-02	Dynamics, exercises	0.0 op
461018A	Dynamics	4.0 op

ECTS Credits:

5 ECTS credits / 120 hours of work

Language of instruction:

Finnish

Timing:

The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 2st spring semester.

Learning outcomes:

The aim of this course is to provide students with the ability to examine the relationship between the forces on a solid body and the resulting motion, position, speed and acceleration of the body. Learning outcomes: Upon completing the required coursework, the student knows and is able to explain the fundamental quantities and the base laws of the classical mechanics. He/she is able to choose an appropriate coordinate system and analyze the motion - position, velocity, and acceleration - of the parts of a device. The student is able to draw a free body diagram of a moving system, and compose and derive the equations of motion for a system using the direct momentum method, the work-energy method, and the impulse-momentum method.

Contents:

Introduction; Kinematics of a particle; Plane kinematics of a rigid body; Kinetics of a particl;. Basics of mechanical vibrations; Kinetics of a system of particles; Plane kinetics of a rigid body.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 45 h / Exercise 30 h / Self-study 45 h.

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:

Salmi, T. (2003) Dynamiikka 1, kinematiikka, Pressus; Salmi, T. (2002) Dynamiikka 2, kinetiikka, 2. p., Pressus. Oheiskirjallisuus: Salonen, E.M. (2000) Dynamiikka I, 8. korj. p., Otatieto; Salonen, E.M. (1999) Dynamiikka II, 8. korj. p., Otatieto; Beer, F., Johnston, E.(2007) Vector Mechanics for Dynamics, 9.ed., McGraw-Hill

Assessment methods and criteria:

This course utilizes continuous assessment. During the course, there are three intermediate exams. In addition to this, the students will be asked to calculate homeworks, and theses homeworks will be assessed. The assessment of the course is based on the learning outcomes of the course. The more detailed assessment criteria are available on the Optima Study Portal.

Grading:

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

Person responsible:

University Lecturer Hannu Koivurova

466102A: Introduction to structural design, 3 - 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Liedes, Hannu Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

485102A Introduction to structural design 5.0 op

460117A-01 Introduction to Structural Design, examination 0.0 op

460117A-02 Introduction to Structural Design, exercise work 0.0 op

460117A Introduction to Structural Design 6.0 op

ECTS Credits:

5 ECTS credits / 132 hours of work

Language of instruction:

Finnish

Timing:

Autumn semester, periods 1-2

Learning outcomes:

After completing the course the student is able to name technical regulations and instructions, which guide construction. After completing the course students can explicate principle of verifications and plastic theory on structure design and also different loads on structure. Student estimate design loads by calculation and design load effect in structures. Student can describe different structure and bracing systems.

Contents:

Regulations and supervising. The principle of design verification. The loads and effect. The principle of using of eurocode. The principle of plastic theory on on structure design. Structure systems. The joints of structures.

Mode of delivery:

Lecture room teaching.

Learning activities and teaching methods:

Lectures and exercises

Target group:

Students studying structural engineering

Prerequisites and co-requisites:

461016A Statics and 460101A Strength of Materials I

Recommended or required reading:

Lecture notes (mainly in Finnish), Finnish law and legislation, National building code of Finland, Eurocode standards

Assessment methods and criteria:

Passed practical works and exam

Grading:

Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:

University teacher Hannu Liedes

485021A: Construction Contracting, 5 op

Voimassaolo: 01.08.2018 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Civil Engineering field

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

488119A	Basics of infrastructure planning and development	5.0 op
466113S	Construction economics	5.0 op
460165A-02	Introduction to Construction Economics I, practical work	0.0 op
460165A-01	Introduction to Construction Economics I, examination	0.0 op

Other information:

This Course replaces courses 466113S and 488119A.

477980S: Master's Thesis in Process Engineering, 30 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Advanced Studies

Laji: Diploma thesis

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
30 ECTS
Language of instruction:
Finnish or English
Timing:
Recommended timing the spring term of the 2nd year of the master level.
Learning outcomes:
Upon completion of the thesis the student recognizes practical problems, she/he be able to create a research plan and research questions. She/He is able to plan the project and manage her/his own work according to the timetable. Student controlls different kind of research methods and be able to apply skills learned during master's studies to solving asked research questions. She/he understand practical meanings of solutions, limited and know if there is some useful outputs. The student can also utilize different information sources and critically evaluate the information obtained. The student is able to produce clear and finalized text, in line with technical and scientific writing practices.
Contents:
The student defines the contents of his / her work, consulting the supervisor of the Master's thesis. The Chief of degree programme accepts the contents, the subject and the topic of the thesis work.
Mode of delivery:
Individual work. The diploma thesis completes the master's degree studies.
Learning activities and teaching methods:
The Master's thesis work is supervised by a staff member of the Faculty and doing with industrial company.
Target group:
Process Engineering Master's students
Prerequisites and co-requisites:
Master's level studies of Degree programme.
Assessment methods and criteria:
The thesis work is made independently by the student as planned. The thesis work is saved digitally and reviewed through the University of Oulu Laturi electronic thesis (E-thesis) submission system. Final written report will evaluate.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Thesis' supervisor
Working life cooperation:
Working in or with the industrial company.

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.

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
Vastuuyksikkö: Applied Mathematics and Computational Mathematics
Arvostelu: 1 - 5, pass, fail
Opettajat: Ilkka Lusikka
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay031010P	Calculus I (OPEN UNI)	5.0 op

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

Finnish. The course can be completed in English by intermediate exams or by a final exam.

Timing:

Autumn semester, period 1

Learning outcomes:

Upon completion of the course, the student identifies concepts of vector algebra, can use vector algebra for solving problems of analytic geometry, can explain basic characteristics of elementary functions, is able to analyse the limit and the continuity of real valued functions of one variable, 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 28 h / Group work 22 h / Self-study 85 h.

Target group:

-

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Grossman, S.I.: Calculus of One Variable; Grossman, 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:

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

Person responsible:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

031021P: Probability and Mathematical Statistics, 5 op

Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Applied Mathematics and Computational Mathematics
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 ECTS credits / 135 hours of work

Language of instruction:

Finnish

Timing:

Spring semester, period 3

Learning outcomes:

After completing the course the student

1. knows the key concepts of probability and the most important random variables,
2. will be able to use them in calculating probabilities and parameters of probability distributions,
3. is capable of analyzing statistical data by calculating interval and point estimates for the parameters,
4. will be able to formulate statistical hypotheses and test them,
5. knows the basics of linear regression.

Contents:

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

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h/Exercises 20 h/Self study 87 h.

Target group:

The students in the engineering sciences. Other students are welcome, too.

Prerequisites and co-requisites:

The recommended prerequisities are the course 031010P Calculus I and some parts of the course 031075P Calculus II.

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:

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:

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

Person responsible:

Jukka Kemppainen

Working life cooperation:

-

Other information:

-

031022P: Numerical Analysis, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Marko Huhtanen

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

Finnish. English speaking students should contact the instructor.
The course can be completed in English by intermediate exams or by a final exam.

Timing:

Spring semester, period 3

Learning outcomes:

Knows numerical algorithms for solving basic problems in computing. Knows basics about numerical linear algebra and some of its applications. Knows how nonlinear systems are solved and how they appear in optimization. Knows how differential equations are solved numerically.

Contents:

Numerical linear algebra, numerical methods for systems of equations, unconstrained optimization, basics of the approximation theory, numerical quadratures, numerical methods for ordinary differential equations.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h / Group work 22 h / Self-study 85 h.

Target group:

-

Prerequisites and co-requisites:

Completion of courses Calculus I and II, a course on Differential Equations and a Course on Linear Algebra.

Recommended optional programme components:

-

Recommended or required reading:

Material posted on the web-page of the course.

Assessment methods and criteria:

Intermediate exams or a final exam.

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:

Marko Huhtanen

Working life cooperation:

-

Other information:

-

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:

Spring periods 3 and 4.

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:

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-economic performance of the process based on holistic criteria.

Contents:

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

Dr Jani Kangas

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

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 the 2nd period. 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:

-

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:

Finnish

Timing:

The course is held in the autumn semester, during period I. It is recommended to complete the course at the 2nd autumn semester.

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 (26 hours), software exercises (4 hours) as well as other exercises. Only in Finnish.

Target group:

Students of process and environmental engineering

Prerequisites and co-requisites:

'Basic Principles in Chemistry' or corresponding knowledge is recommended as prerequisite.

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. It is also available via courses www-site.

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.

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:

There is no direct working life cooperation in this course.

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.

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: Marko Paavola

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:

Marko Paavola

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:

Aki Sorsa

Working life cooperation:

No

Other information:

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

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 credits/133 hours of work

Language of instruction:

Finnish but also option to complete the course in English

Timing:

The course is held in the autumn semester during the period 1. It is recommended to complete the course at the 1st autumn semester of the international master program of environmental engineering

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 rela-tion to snowmelt, evaporation, infiltration and groundwater flow.

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.

Mode of delivery:

Face-to-face teaching and independent work with two assignment reports.

Learning activities and teaching methods:

Lectures 10 h, exercises 16 h and independent work 109 h. Totally 135 h.

Target group:

Students in international master programs of environmental engineering

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the following course or having corresponding knowledge prior to enrolling for the course unit: 477201A Material and Energy Balances and 477052A Fluid mechanics.

Recommended optional programme components:

The course is a prerequisite for most of 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:

The 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 assignment reports (80%) and examination (20%).

Grading:

The 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 assignment reports (80%) and examination (20%).

Person responsible:

University Lecturer Anna-Kaisa Ronkanen

Working life cooperation:

Examples solev in the lectures based on real problems

Other information:

The English version of the course is organized parelle to Finnish version of the course.

031076P: Differential Equations, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Ruotsalainen Keijo

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

Finnish

Timing:

The course is held in the spring, during period 4. It is recommended to complete the course at the 1th spring semester.

Learning outcomes:

The students can apply differential equations as a mathematical model. They can identify and solve various differential equations and they have knowledge on basic solvability of differential equations. The student can use the Laplace transform as a solution method.

Contents:

Ordinary differential equations of first and higher order.
Laplace transform with applications to differential equations.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h / Group work 22 h / Self-study 85 h.

Target group:

1. year students of technical sciences, mathematics and physics.

Prerequisites and co-requisites:

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

Recommended optional programme components:

-

Recommended or required reading:

Recommented literature: Kreyszig, E: Advanced Engineering Mathematics;

Assessment methods and criteria:

The course can be completed by intermediate exams (2 exams) or by a final exam.
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:

Keijo Ruotsalainen

Working life cooperation:

-

Other information:

-

031075P: Calculus II, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Applied Mathematics and Computational Mathematics
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 ECTS credits / 135 hours of work

Language of instruction:

Finnish. The course can be completed in English by intermediate exams or by a final exam.

Timing:

Spring semester, period 3

Learning outcomes:

Upon completion of the course, the student is able to examine the convergence of series and power series of real terms, can explain the use of power series e.g. in calculating limits, 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 22 h / Self-study 85 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the course 031010P Calculus I.

Recommended optional programme components:

-

Recommended or required reading:

Kreyszig, E: Advanced Engineering Mathematics; Grossman S.I.: Multivariable Calculus, Linear Algebra, and Differential Equations; Adams, R.A.: A Complete Course Calculus.

Assessment methods and criteria:

Intermediate exams or a final exam.
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:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

031078P: Matrix Algebra, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

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

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

Finnish

Timing:

The course is held in the autumn, during period 2. It is recommended to complete the course at the 1th autumn semester.

Learning outcomes:

The student is able to apply arithmetic operations of matrices and can solve system of linear equations by matrix methods and can apply matrix factorizations to find the solution of the system of linear equations. The student is able to recognize the vector space and understands the concepts of basis and dimension of a vector space and can analyse matrices by the parameters, vectors and vector spaces of matrices. He /She knows how to calculate determinant, eigenvalues and eigenvectors of a square matrix, and is able to diagonalize matrices and apply diagonalization to the simple problems.

Contents:

1. Vectors and matrices 2. Systems of linear equations. 3. Matrix factorizations. 4. Vector spaces. 5. The rank, nullity, row space and the column space of a matrix. 6. The determinant of a matrix. 7. Eigenvalues and eigenvectors of a matrix. 8. The diagonalization with applications.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h / Group work 22 h / Self-study 85 h.

Target group:

1. year students of technical sciences, mathematics and physics.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Recommented literature: Grossman, S.I: Elementary Linear Algebra; David C. Lay: Linear Algebra and Its Applications.

Assessment methods and criteria:

The course can be completed by intermediate exams (2 exams) or by a final exam.
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:

Matti Peltola

Working life cooperation:

-

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

Opettajat: Elisa Koivuranta

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 equipment 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 or with web learning.

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 three intermediate exams with potential web learning, lecture diary and/or homework. 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:

Elisa Koivuranta

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

Opettajat: Elisa Koivuranta

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 equipment and phenomena related to them. In addition, the student can explain application of unit processes and can describe their operational principles.

Contents:

Liquid and suspensions: 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 or with web learning.

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 three intermediate exams with potential web learning, lecture diary and/or homework. 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:

Elisa Koivuranta

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

Opettajat: Ahola, Juha Lennart

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

Opettajat: Ainassaari, Kaisu Maritta

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.

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:

The course 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 Kaisu Ainassaari

Working life cooperation:

No

Other information:

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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

Opettajat: Ainassaari, Kaisu Maritta

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.

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:

The course 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 4 intermediate exams. The course can also be completed by final examination.

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:

-

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

Opettajat: Hiltunen, Jukka Antero

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 2

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

Opettajat: Hiltunen, Jukka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

477602A	Control System Analysis	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

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

Opettajat: Hiltunen, Jukka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

477603A	Control System Design	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

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:

-

477013P: Introduction to Process and Environmental Engineering, 5 op

Voimassaolo: 01.12.2016 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

ECTS Credits:

5 cr / 135 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 1st autumn semester.

Learning outcomes:

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

Contents:

1. Unit operations. 2. Material balances. 3. Phenomenon-based considerations. 4. Material transport. 5. Process control and automation. 6. Principles in use, planning and protection of water and land resources: primary production, municipalities and industry. 7. Energy systems. 8. Productive activity as a part of society.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Pair exercises and contact-education that supports these exercises. The amount of classroom education is 16-32 hours the rest being studying independently. Only in Finnish.

Target group:

Students of process and environmental engineering

Prerequisites and co-requisites:

No prerequisities.

Recommended optional programme components:

This course is an introduction to the other courses of process and environmental engineering. Additionally, this course has connections to the course of Technical communication (900060A). It is recommended to complete these courses simultaneously if possible.

Recommended or required reading:

Material will be distributed during lectures and via courses www-site. Students are required to acquire additional material for the exercises.

Assessment methods and criteria:

This course utilizes continuous assessment. During the course, there are eight exercises that are made as pair-work. Please note that the course is not organised in English.

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:

There is no direct working life cooperation in this course.

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.

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
Opettajat: Esko Juuso
Opintokohteen kielet: Finnish
Leikkaavuudet:

477503S	Simulation	3.0 op

ECTS Credits:

5 ECTS / 135 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

Opettajat: Aki Sorsa

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS /135 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:

Aki Sorsa

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 (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

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

Opettajat: Seppo Honkanen

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

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 477621A Control system analysis and 477622A 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, 135 h of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

Timing:

Period 3

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 477621A Control system analysis, 477622A Control system design and 477624S Control system methods recommended beforehand

Recommended or required reading:

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

Assessment methods and criteria:

Exam and homework

Grading:

Numerical grading scale 1.5 or fail

Person responsible:

Professor Enso Ikonen

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

Opettajat: Esko Juuso

Opintokohteen kielet: Finnish

Leikkaavuudet:

477505S	Fuzzy-neuromethods in Process Automation	4.0 op

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

Finnish and English

Timing:

Implementation in the spring term, on the 3rd period. Recommended for 4th 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

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Kotila, Vesa Iisakki

Opintokohteen kielet: Finnish

Leikkaavuudet:

031050A	Signal Analysis	4.0 op

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

Finnish.

The course can be completed in English by a final exam or a retake exam.

Timing:

The course is held in the autumn semester, during period II. It is recommended to complete the course at the 2nd autumn semester.

Learning outcomes:

Upon completion of the course, the student:
-is able to calculate the energy, the power, the convolution and the frequency spectrum of discrete and analog, periodic and non-periodic deterministic signals
-is able to calculate the spectrum of a sampled signal
-is able to calculate the Hilbert transform and the complex envelope of a signal
-is able to study the stationarity, the mutual dependence and the frequency content of random signals by means of the auto- and cross-correlation functions, and the power- and cross-power spectral densities
-is able to study the effect of an LTI system on a signal

Contents:

Signals, classification, frequency. Fourier analysis, analog and digital signal, fast Fourier transform. LTI system. Hilbert transform. AM- FM- and PM-modulation. Random variable. Covariance matrix. Random signal. Stationarity, autocorrelation. Power spectral density. Random signal in LTI system. Signal estimation.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures 28 h / Exercises 14 h / Self-study privately or in a group 93 h. The independent work includes individual STACK-assignments as online work.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the courses 031078P Matrix Algebra, 031021P Probability and Mathematical Statistics and 031077P Complex Analysis.

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:

Lecture notes. Additional reading: Proakis, J.G., Manolakis, D.K.: Introduction to Digital Signal Pro-cessing. Shanmugan, K.S., Breipohl, A.M.: Random Signals, Detection, Estimation and Data Analysis.

Assessment methods and criteria:

The course is completed with a final exam or a retake exam. In addition to the final exam, STACK-assignments given during the course are part of the assessment. The assessment of the course is based on the learning outcomes of the course.
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:

Vesa Kotila

Working life cooperation:

-

Other information:

-

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 /135 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 Dynamics (previous 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

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:

Dr Aki Sorsa

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: Jari Ruuska
Opintokohteen kielet: English

ECTS Credits:

5 ECTS /135 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:

Jari Ruuska

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

Opettajat: Jenö Kovács

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

Timing:

Period 3 (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 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

Working life cooperation:

No

Other information:

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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: Marko Paavola
Opintokohteen kielet: Finnish
Leikkaavuudet:

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

ECTS Credits:

5 ECTS /135 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:

Marko Paavola

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

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
Opettajat: Elisa Koivuranta
Opintokohteen kielet: English
Leikkaavuudet:

477104S	Chemical Processing of Biomasses	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 identify lignocellulosic raw material sources, their properties, their main components and utilization potential of components. The student also identifies 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 36 h, web learning and self-study 97 h. A part of the teaching can be replaced by group work or home work.

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 three intermediate exams with potential web learning, lecture diary and/or homework. 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:

Elisa Koivuranta

Working life cooperation:

A visit/excursion to the local pulp mill and/or visiting lecturers from the industry, when feasible.

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

Opettajat: Elisa Koivuranta

Opintokohteen kielet: English

Leikkaavuudet:

477105S	Mechanical Processing of Biomasses	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 34 h, web learning and self-study 99 h. A part of teaching can be replaced by group work or home work.

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 three intermediate exams with potential web learning, lecture diary and/or homework. 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:

Elisa Koivuranta

Working life cooperation:

Visiting lecturers from the industry and/or a visit/excursion to a local manufacturing site, when feasible.

Other information:

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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

Opettajat: Elisa Koivuranta

Opintokohteen kielet: English

Leikkaavuudet:

477128S	Circular Bioeconomy	5.0 op
477106S	Recycled Fiber Processes	3.0 op
477105S	Mechanical Processing of Biomasses	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 36 h, web learning and self-study 97 h. A part of the teaching can be replaced by group work or home work.

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 three intermediate exams with potential web learning, lecture diary and/or homework. 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:

Elisa Koivuranta

Working life cooperation:

Visiting lecturers from the industry, when feasible.

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
Opettajat: Elisa Koivuranta
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 with a written case-study.

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 identifies 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 (in Finnish) 42 h, a written case study as group work, which is presented to course participants, 40 h. Excursion to local paper mill and printing laboratory 3 h. Self-study 48 h.

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. Separate study material for the English book exam for foreign students.

Assessment methods and criteria:

End exam and written case-study.

Grading:

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

Person responsible:

Elisa Koivuranta

Working life cooperation:

Lecturer from the industry and an excursion to the local paper mill.

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

Opettajat: Elisa Koivuranta

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 or Finnish

Timing:

Implementation (registration) during autumn periods 1-2, completion throughout the year with mutual agreement.

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 possibly by oral presentation.

Target group:

Students interested in bioeconomy or circular economy.

Prerequisites and co-requisites:

Studies in the field of bioproduct technology or circular economy 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:

Elisa Koivuranta

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 and analysis equipment.

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

Opettajat: Petri Tervasmäki

Opintokohteen kielet: English

Leikkaavuudet:

488304S	Bioreactor Technology	6.0 op

ECTS Credits:

5 ECTS /135 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 61 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. upplementary material: Villadsen J., Nielsen J., Liden G. Bioreactor engineering principles. Springer Verlag, 2011. Shuler ML., Kargi F. Bioprocess engineering basic consepts. 2nd ed. Pearson. 2002 and 2014.

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:

Petri Tervasmäki

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

Opintokohteen kielet: English

Leikkaavuudet:

480450S	Bioprocesses III	5.0 op

ECTS Credits:

5 ECTS /135 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. 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 51 h.

Target group:

Master students in bioprocess engineering. Master students in process engineering, environmental 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, exercises and 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:

Johanna Panula-Perälä

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: Ville-Hermanni Sotaniemi

Opintokohteen kielet: English

Leikkaavuudet:

488310S	Laboratory Course in Microbiology	2.0 op

ECTS Credits:

5 ECTS /135 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, if 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 28 h.

Target group:

Master’s students of bioprocess engineering.

Prerequisites and co-requisites:

Courses 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering, 488321S 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 and written report.

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:

-

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

Opettajat: Ville-Hermanni Sotaniemi

Opintokohteen kielet: Finnish

Leikkaavuudet:

488307S	Bioprocess Engineering	7.0 op

ECTS Credits:

5 ECTS /135 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. 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 and literature research 63h

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:

Dr Sanna Taskila

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 and Finnish

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 and workshops. 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, exchange 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:

Problem-based exercises and a final exam will count towards the final grade.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5/fail.

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 /135 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 Dynamics (previous Process Control Engineering I) or respective recommended beforehand

Recommended optional programme components:

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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

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:

Dr Aki Sorsa

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

Opettajat: Jani Kangas

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /135 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 46 h and self-study 87 h

Target group:

Students in the study options Process Design and Chemical Engineering

Prerequisites and co-requisites:

Essential contents of 477401A Thermodynamic equilibria course, or equivalent knowledge on the basic concepts of thermodynamic equilibria.

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:

Dr Jani Kangas

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: 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 477322A 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.
Oheiskirjallisuus: Walas, S.M.: Phase Equilibria in Chemical Engineering; Henley, E.J. & Seader, J. D.: Equilibrium-stage Separation Operations in Chemical Engineering.

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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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: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

470222A Reactor Analysis and Design II 5.0 op

ECTS Credits:

5 ECTS / 135 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 ((i.e. multicomponent and multiphase 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 and computer simulations (CFD), face-to-face teaching.

Learning activities and teaching methods:

Lectures 30 h, exercises and simulation 14 h, homework 16 h, self-study 75 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:

Fogler, H. Scott: Elements of chemical reaction engineering. (5th edition) 2016. Prentice Hall PTR: Pearson Education International; Nauman, E.B.: Chemical Reactor Design. New York, John Wiley & Sons.1987;
Additional literature: Winterbottom, J.M. & King, M.B. (Editors) Reactor Design for Chemical Engineers. Padstow 1999, T.J. International Ltd. 442 s. 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:

Intermediate exams (2) or final 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:

University Lecturer Mika Huuhtanen

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: Jani Kangas, Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

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 and biochemicals 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 novel 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:

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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

Opettajat: Ahola, Juha Lennart

Opintokohteen kielet: English

Leikkaavuudet:

477206S	Advanced Process Design	6.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

Timing:

Spring, periods 3 and 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 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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A431238: Module of the Option/Chemical Engineering, 60 op

Voimassaolo: 01.08.2017 -

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

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: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

470222A	Reactor Analysis and Design II	5.0 op

ECTS Credits:

5 ECTS / 135 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 ((i.e. multicomponent and multiphase 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 and computer simulations (CFD), face-to-face teaching.

Learning activities and teaching methods:

Lectures 30 h, exercises and simulation 14 h, homework 16 h, self-study 75 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:

Fogler, H. Scott: Elements of chemical reaction engineering. (5th edition) 2016. Prentice Hall PTR: Pearson Education International; Nauman, E.B.: Chemical Reactor Design. New York, John Wiley & Sons. 1987;
Additional literature: Winterbottom, J.M. & King, M.B. (Editors) Reactor Design for Chemical Engineers. Padstow 1999, T.J. International Ltd. 442 s. 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:

Intermediate exams (2) or final 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:

University Lecturer Mika Huuhtanen

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

Opettajat: Satu Pitkäaho

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. Student is capable of specifying the process steps in catalyst design, selection and testing. Student 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 a catalyst and catalysis, history of catalysis, economical, social and environmental meaning. Kinetics and mechanisms of catalytic reactions. Catalyst materials and structure, characterization, design and preparation, and testing of catalysts. Catalysis in industry. Environmental catalysis.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 40 h, exercises 10 h, homework 20 h, teamwork presentations 10 h, and 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:

Postdoctoral researcher Satu Pitkäaho

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: Ainassaari, Kaisu Maritta

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 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 and visiting scientists.

Mode of delivery:

Face-to-face teaching and seminars.

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:

Docent Esa Muurinen

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

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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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: 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 477322A 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.
Oheiskirjallisuus: Walas, S.M.: Phase Equilibria in Chemical Engineering; Henley, E.J. & Seader, J.D.: Equilibrium-stage Separation Operations in Chemical Engineering.

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 / 135 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:

In the Finnish version: Lectures and compulsory exercise done in small groups. In the English version, compulsory simulation exercise done in small groups and a book exam, which replaces the lectures given in Finnish.

Learning activities and teaching methods:

Lectures 252h, and exercise 8 h, project work 10 h, self-study 93 h. For foreign students written examination based on given literature and a compulsory 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:

The course 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 simulation 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
Opettajat: Jani Kangas
Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /135 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 46 h and self-study 87 h

Target group:

Students in the study options Process Design and Chemical Engineering

Prerequisites and co-requisites:

Essential contents of 477401A Thermodynamic equilibria course, or equivalent knowledge on the basic concepts of thermodynamic equilibria.

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:

Dr Jani Kangas

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 /135 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 46 h and group work 89 h

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

Opettajat: Aki Sorsa

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay477524S Process Optimization (OPEN UNI) 5.0 op

477504S Process Optimization 4.0 op

ECTS Credits:

5 ECTS /135 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:

Aki Sorsa

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

Opettajat: Ahola, Juha Lennart

Opintokohteen kielet: English

Leikkaavuudet:

477206S	Advanced Process Design	6.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

Timing:

Spring, periods 3 and 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 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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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: Jani Kangas, Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

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 and biochemicals 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 novel 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 /135 hours of work

Language of instruction:

English.

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

Prerequisites and co-requisites:

-

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:

-

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.

Choose 30 or 60 ECTS

477415S: Thermodynamic and process modelling in metallurgy, 5 op

Voimassaolo: 28.11.2016 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Eetu-Pekka Heikkinen
Opintokohteen kielet: English

ECTS Credits:

5 cr / 135 hours of work.

Language of instruction:

English

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 can use computational methods (i.e. HSC Chemistry -software) to investigate the thermodynamic equilibria (e.g. in metallurgy and mineral processing). These thermodynamic considerations include 1) equilibrium calculations, 2) mass and heat balances as well as 3) phase diagrams. Additionally, they can use commercial process simulation software (i.e. HSC Sim -software) to model metallurgical processes. This means that the student will know how to 1) model flowsheets for various processes, 2) apply simulation in practical problems and 3) run calculation and analyse the results.

Contents:

Course is divided in two parts. Part I focuses on thermodynamic modelling in the contexts of metallurgy: How to use HSC Chemistry as well as its modules (Reaction equations, Equilbrium compositions, Heat & Material balances, H, S, CP, G diagrams, Stability diagrams, Eh-pH diagrams, Measure units, Periodic chart, Species converter) and database? How to define a system? How to interpret results? Part II focuses on general information and exercises in HSC-Sim (Flowsheet simulation -module): HSC-Sim structure and user interface, toolbar, drawing a flowsheets with HSC Sim, data necessary for building up a simulation in mineral processing, structure of HSC Sim Distribution mode, simulation of metallurgical balance.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Simulation exercises (work in pairs) supported by the contact-education, which consists of simulation exercises (48 hours). The rest is individual work outside the lectures.

Target group:

SStudents of process metallurgy.

Prerequisites and co-requisites:

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

Recommended optional programme components:

This course is one of the courses of pyrometallurgy in the module of process metallurgy.

Recommended or required reading:

Material will be distributed during the lectures and exercises. Each student is required to search additional material for the exercises when necessary.

Assessment methods and criteria:

Continuous assessment consisting of simulation exercises and reports based on the exercises. Work in pairs. No final exams are organized.

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:

The course includes guest lectures from the industry.

Other information:

Due to continuous assessment used in this course, it is highly recommended that the students are present already in the first lecture.

477416S: High temperature processes, 5 op

Voimassaolo: 28.11.2016 - 31.07.2022

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:

477427A High temperature processes 5.0 op
ay477416S High temperature processes (OPEN UNI) 5.0 op

ECTS Credits:

5 cr / 135 hours of work.

Language of instruction:

Finnish

Timing:

The course is held in the autumn semester, during period I. It is recommended to complete the course at the 4th autumn semester.

Learning outcomes:

SStudents passing the course are familiar with the metal production processes and metallurgical unit operations. Additionally, students know how to evaluate high temperature processes from different perspectives (energy and reductants, refractory materials, slags and ashes, waste and emissions as well as automation, measurements and modelling).

Contents:

The most important pyrometallurgical unit operations and other high temperature processes as well as things that need to be taken into account when considering high temperature processes (e.g. energy and reductants, refractory materials, slags and ashes, waste and emissions as well as automation, measurements and modelling).

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Lectures (approximately 45 hours) supporting the exercises that are made during the course. Only in Finnish.

Target group:

Students of process metallurgy.

Prerequisites and co-requisites:

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

Recommended optional programme components:

This course is one of the courses of pyrometallurgy in the module of process metallurgy.

Recommended or required reading:

Material will be distributed during lectures and exercises. It is also available via courses www-site. Each student is required to search additional material for the exercises when necessary.

Assessment methods and criteria:

Continuous assessment consisting of exercises that are made during the course. Please note that the course is organised only in Finnish.

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:

The course includes a seminar day organized together with industry.

Other information:

Due to continuous assessment used in this course, it is highly recommended that the students are present already in the first lecture.

477417S: High temperature chemistry, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

ECTS Credits:

5 cr / 135 hours of work.

Language of instruction:

Finnish

Timing:

The course is held in the autumn semester, during period 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 high temperature processes. Students can e.g. calculate thermodynamic equilibria, read and construct phase stability diagrams as well as estimate reaction rates and the effect of surface and interfacial phenomena on high temperature processes, etc.

Contents:

Models and methods that are used to investigate the chemical reactions in the research and development of high temperature processes. Contents are divided into five categories: 1. Compound and phase stabilities. 2. Thermodynamic modelling of pyrometallurgical solutions. 3. Reaction kinetics in high temperature systems. 4. Burning. 5. Interfacial phenomena.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Lectures (40 hours) supporting the exercises that are made during the course. Only in Finnish.

Target group:

Students of process metallurgy.

Prerequisites and co-requisites:

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

Recommended optional programme components:

This course is one of the courses of pyrometallurgy in the module of process metallurgy.

Recommended or required reading:

Material will be distributed during lectures and exercises. It is also available via courses www-site. Each student is required to search additional material for the exercises when necessary.

Assessment methods and criteria:

Continuous assessment consisting of exercises that are made during the course. Please note that the course is organised only in Finnish.

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:

There is no direct working life cooperation in this course.

Other information:

Due to continuous assessment used in this course, it is highly recommended that the students are present already in the first lecture.

477418S: Experimental methods of high temperature research, 10 op

Voimassaolo: 28.11.2016 - 31.07.2021

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Tanskanen

Opintokohteen kielet: Finnish

Leikkaavuudet:

477426S	Characterisation methods of inorganic materials	5.0 op

ECTS Credits:

10 cr / 270 hours of work.

Language of instruction:

Finnish

Timing:

The course is held 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 high temperature 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 high temperature 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 (96 hours) that supports these exercises.

Target group:

Students of process metallurgy.

Prerequisites and co-requisites:

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

Recommended optional programme components:

This course is one of the courses of pyrometallurgy in the module of process metallurgy.

Recommended or required reading:

Material will be distributed during lectures and exercises. It is also available via courses www-site. Each student is required to search additional material for the exercises when necessary.

Assessment methods and criteria:

Continuous assessment consisting of group-exercises and reports. Please note that the course is organized only in Finnish.

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:

The students implement a small R&D project in which genuine challenge or problem is studied.

Other information:

Due to continuous assessment used in this course, it is highly recommended that the students are present already in the first lecture. The amount of students participating in this course may be limited.

477419S: Seminar in metallurgy, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

ECTS Credits:

5 cr / 135 hours of work.

Language of instruction:

Finnish, English if necessary

Timing:

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

Learning outcomes:

Student can describe a metallurgical company and its production, evaluate one's own work and its role as well as prepare and give a written and oral seminar presentation.

Contents:

Course consists of seminar presentations prepared and given by students. Each student must prepare four presentations with topics based on their work experience in metallurgical industry or research institute. Topics are: 1. company presentation, 2. presentation of production chain, 3. description of student's own work at the company and 4. literature survey on the given topic.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Seminars (max. 32 h) for which students prepare presentations. Attendance in the seminars is mandatory. Presentations are prepared outside these classroom education hours.

Target group:

Students of process metallurgy.

Prerequisites and co-requisites:

Knowledge and skills corresponding the knowledge and skills that are obtained from the Bachelor-level-studies in the programme of process or environmental engineering as well as work experience (e.g. summer training period) from metallurgical industry or research institute are recommended as prerequisities. In order to get credits from this course, bachelor thesis must be completed.

Recommended optional programme components:

This course is one of the courses of pyrometallurgy in the module of process metallurgy.

Recommended or required reading:

Students create the study materials themselves as a part of seminar work. This requires independent search of source material.

Assessment methods and criteria:

Students are required to prepare and give seminar presentations on given topics (written and oral).

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:

Seminar presentations within this course are based on students' experience in industry and/or research organisations.

Other information:

Due to continuous assessment used in this course, it is highly recommended that the students are present already in the first lecture.

781649S: Sampling and Sample Pretreatment, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced 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. English on demand.

Timing:

4th or 5th spring. The course is lectured every other year, next time during the spring 2019.

Learning outcomes:

After this course student becomes aware of the importance of correct sampling (especially heterogeneous solid materials). The student also gets knowledge how to i) sample and ii) prepare samples for various types of analysis: determination of total element concentrations (incl. ultra trace levels), fractionation of elements and element speciation analysis. At the end of the course the students should have also acquired an understanding of the techniques that are used in sample preconcentration and matrix separation, as well as purification of reagents and laboratory tools when very low element concentrations are measured.

Contents:

Representative sampling and sampling errors, various sample preparation techniques utilizing open and closed systems and their use in the determination of total element concentrations in inorganic and organic sample types. Fusion techniques and fire assay methods. Sample preparation in trace element fractionation and speciation analysis. Systematic errors in analysis (losses and contamination), clean rooms, separation and preconcentration techniques.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

30 hours of lectures + seminar presentation + 104 hours of self-study

Target group:

Chemistry, optional

Prerequisites and co-requisites:

Introduction to Analytical Chemistry (780111P or 780119P)

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:

Sirén, H., Perämäki, P., Laiho, J.: Esikäsittelyn käsikirja, Kemian Kustannus Oy, 2009 and material handed out by the lecturer.

Assessment methods and criteria:

Final examination or home assignment.

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:

Paavo Perämäki

Working life cooperation:

No

Other information:

No

781657S: Experimental Design, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced 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. English on demand.

Timing:

4th or 5th spring. The course is lectured every other year, next time during the spring 2020.

Learning outcomes:

After this course student becomes aware of importance experimental design and is able to apply most common experimental designs in the field of chemistry.

Contents:

Factorial designs, mixture designs, D-optimal designs, response surface methodology. Computer programmes are applied during the course in the design and analysis of experiments.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

30 hours of lectures and exercises + 104 hours of self-study incl. computer aided analysis of experimental data.

Target group:

Chemistry, optional

Prerequisites and co-requisites:

Metrological Fundamentals of Analytical Chemistry (781651S)

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:

Montgomery, D.C.: Design and Analysis of Experiments, 8^{th} ed., John Wiley & Sons.
Massart, D.L., Vandeginste, B.G.M., Buydens, L.M.C., De Jong, S., Lewi, P.J. and Smeyers-Verbeke, J.: Handbook of Chemometrics and Qualimetrics: Part A, Elsevier, 1997, partly.

Assessment methods and criteria:

Final examination or home assignment
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:

Paavo Perämäki

Working life cooperation:

No

Other information:

No

782640S: Chemistry of Hydrometallurgical Processes, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced 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, English on demand

Timing:

4th or 5th spring. The course is lectured every other year, next time during the spring 2017.

Learning outcomes:

Upon completion of the course, the student will be able to explain chemical principles of hydrometallurgical processes and phenomena. The student knows the most important chemical reactions and variables affecting hydrometallurgical processes. Process chemistry is significant in several industrial applications, and those applications are considered during the course.

Contents:

Introduction to hydrometallurgical processes, pre-treatment of concentrates (oxidation, heat treatment), principles of dissolution (including leaching and bioleaching) and purification, chemical precipitation and other metals recovery processes (extraction, ion-exchange), electrical processes and process chemistry (electrolysis, corrosion).

Mode of delivery:

Face-to-face teaching and seminars

Learning activities and teaching methods:

40 hours of lectures, 10 hours of seminars, 84 hours of self study

Target group:

Chemistry, optional

Prerequisites and co-requisites:

Physical Chemistry I and Physical Chemistry II

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:

Lecture notes (in English).

Assessment methods and criteria:

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:

Ulla Lassi

Working life cooperation:

No

Other information:

No

782638S: Chemistry in Industrial Applications, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Chemistry

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

782338A	Chemistry in Industrial Applications	5.0 op
ay782638S	Chemistry in Industrial Applications (OPEN UNI)	5.0 op

ECTS Credits:

5 credits / 134 hours of work

Language of instruction:

Finnish/English on demand

Timing:

4th or 5th spring. The course is lectured every other year, next time during the spring 2018.

Learning outcomes:

Upon completion of the course, the student will be able to explain several chemical applications in process and environmental technology. In particular, the student knows the novel applications in which chemistry is used.

Contents:

Catalytic applications in water purification, catalytic oxidation, preparation of biofuels from biomass, biomass gasification and the utilisation of biogas, chemistry and chemical reactions in mining processes etc. (visiting lecturers from the companies)

Mode of delivery:

Face-to-face teaching and seminars

Learning activities and teaching methods:

40 hours of lectures, 10 hours of seminars, 84 hours of self-study

Target group:

Chemistry, optional

Prerequisites and co-requisites:

Physical Chemistry I and Physical Chemistry II

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:

Material given by the lecturer, scientific review papers

Assessment methods and criteria:

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:

Ulla Lassi

Working life cooperation:

No

Other information:

No

782637S: Surface Chemistry, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced 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/English on demand

Timing:

4th or 5th autumn. The course is lectured every other year, next time during the autumn 2017.

Learning outcomes:

Upon completion of the course, the student will be able to explain the essential phenomena of surface chemistry, such as surface tension, interfaces and surface reactions. The student knows the properties of liquid surfaces and interfaces, and the role of surface active agents. The student will be able to explain properties of surfaces and surface phenomena. The student knows the most important surface structures and methods used in surface science studies. Surface phenomena are significant in several industrial applications, and those applications are theoretically studied during the course.

Contents:

Properties of liquid-gas, liquid-liquid, solid-gas and solid-liquid interfaces. Surface structures, Surface phenomena and Surface analytical methods. A wide range of applications are considered on molecular level, such as emulsions, foams, flotation, nucleation, surface active agents.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

5O hours of lectures, 84 hours of self-study

Target group:

Chemistry, optional

Prerequisites and co-requisites:

Physical Chemistry I and Physical Chemistry II

Recommended optional programme components:

Previous courses Surface Chemistry I and Surface Chemistry II

Recommended or required reading:

Adamson, A.W.: Physical Chemistry of Surfaces, 6. painos, John Wiley & Sons, New York, 1997 (partly); Somorjai, G.A.: Introduction to Surface Chemistry and Catalysis, John Wiley & Sons, New York, 1994 (partly). Final examination is based on the lectures.

Assessment methods and criteria:

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:

Ulla Lassi

Working life cooperation:

No

Other information:

No

782639S: Electrochemistry, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced 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/English on demand

Timing:

4th or 5th autumn. The course is lectured every other year, next time during the autumn 2018.

Learning outcomes:

Upon completion of the course, the student will be able to explain the essential phenomena of electrochemistry, such as electrochemical reactions, electrolytes and related thermodynamics. The student knows the principle of electrochemical cells (batteries and fuel cells) and kinetics of electrochemical reactions. These phenomena are significant in chemical and metal industry, such as in metal recovery by electrolysis.

Contents:

Introduction to electrochemistry, electrochemical reactions and reaction kinetics, electrolytes and thermodynamics of electrolytic solutions, electrochemical cells (batteries and fuel cells), measurement methods of electrochemical properties, applications of electrochemistry.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

50 hours of lectures, 84 hours of self study

Target group:

Chemistry, optional

Prerequisites and co-requisites:

Physical Chemistry I and Physical Chemistry II

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:

Murtomäki, L., Kallio, T., Lahtinen, R. & Kontturi, K.: Sähkökemia, 2. painos, Korpijyvä Oy, Jyväskylä, 2010; Bockris, J.O´M., Reddy, A.K.N.: Modern Electrochemistry, vol 1, 2. painos, Plenum Press, New York, 1988, partly, lecture notes. Examination based on the lectures.

Assessment methods and criteria:

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:

Ulla Lassi

Working life cooperation:

No

Other information:

No

780670S: Special Lecture, 0 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Chemistry
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Ei opintojaksokuvauksia.

A431239: Module of the Option/ Energy Systems and Cleaner Production, 60 op

Voimassaolo: 01.08.2017 -
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

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: Jani Kangas, Tanskanen, Juha Petri
Opintokohteen kielet: Finnish
Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

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 and biochemicals 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 novel 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

Opettajat: Satu Pitkäaho

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. Student is capable of specifying the process steps in catalyst design, selection and testing. Student 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 a catalyst and catalysis, history of catalysis, economical, social and environmental meaning. Kinetics and mechanisms of catalytic reactions. Catalyst materials and structure, characterization, design and preparation, and testing of catalysts. Catalysis in industry. Environmental catalysis.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 40 h, exercises 10 h, homework 20 h, teamwork presentations 10 h, and 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:

Postdoctoral researcher Satu Pitkäaho

Working life cooperation:

No

Other information:

-

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

Opettajat: Väisänen, Virpi Maria

Opintokohteen kielet: English

Leikkaavuudet:

488402A	Sustainable Development	3.0 op

ECTS Credits:

5 cr / 133 hours of work

Language of instruction:

English

Timing:

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 4 h / student presentations (guided group work), discussions, opponency 26 h / court case simulation 5 h / home work 98 h.

Target group:

Master's students of environmental engineering, especially of international master's programmes such as the Master's Degree Programme in Environmental Engineering

Prerequisites and co-requisites:

For Environmental Engineering 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 and learning diary. Compulsory requirements are presence on at least 80% of face-to-face lectures, participation in the group works, presenting own presentation and acting as an opponent to another presentation.

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

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 / 135 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 30 h / Self-study 75 h. The exercises are completed as guided 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:

-

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 / 135 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 95 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 or 477013P Introduction to Process and Environmental Engineering 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:

-

Choose the other

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) Starting research work: research types, funding, the process of research work, finding the research area, choosing the research topic, information sources. 2) 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. 3) Reporting: writing a scientific text, referring, plagiarism, writing scientific theses and reports. 4) Other issues connected to research work: ethical issues, integrity, and future. 5) 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.

488143S: Environmental Impact Assessment, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannu Marttila

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course is held in the autumn semester during the 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 and project work

Learning activities and teaching methods:

The amount of lecture hours can varied depending teaching resources in every year but independent project working is the main activities in the course. Work load in the course is totally 133 h. The project work is completed as group work.

Target group:

Only master students in Water resources and environmental engineering major in the Environmental Engineering Master Program

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 assignment (60 %) and seminar (40%). More information about assessment methods 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:

Docent Hannu Marttila

Working life cooperation:

The course includes the guest lectures from local companies and authorities. The assignment is based on case studies that are rael on-going or passed EIA projects.

Other information:

Maximum number of the students in the course is 20.

Choose Energy Systems or Cleaner Production

H432232: Module of the Option/Energy Systems, 30 op

Voimassaolo: 01.08.2017 -

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

488501S: Smart Grid I: Integrating renewable energy sources, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eva Pongracz

Opintokohteen kielet: English

ECTS Credits:

5 cr/150 hours of work

Language of instruction:

English

Timing:

Period 2

Learning outcomes:

The student is able to explain the concept of smart grids, the evolution of smart grids from electricity power grids, the information technology requirements as well as the economic, environmental and social implications of smart grids. The student will know the expectations from smart grids and is able to outline the future perspectives of smart grid-based energy systems.

Contents:

Multidisciplinary course, offered in cooperation of the Faculty of Technology (Energy and Environmental Engineering Research Unit - EEE), Oulu Business School (OBS, Department of Economics) and the Faculty of Information Technology and Electrical Engineering (Centre of Wireless Communication - CWC). After an introductory presentation on the requirements, the background is set on the energy and environmental crisis, the co-evolution of energy and information systems and outlining the transition to a smarter system. Further, lectures on smart grids will be provided from an electrical engineering and information technology view on the evolution of electricity power grids, power generation transmission and distribution; distributed generation and futures of smart grids. From an environmental engineering point of view, lectures will be delivered on energy systems fundamentals, climate goals and decarbonization, as well as on the sustainability of smart grids will in particular the environmental and social impacts of smart grids. From economics points of view, lectures will be given on the liberalization and deregulation of the electricity market, electricity pricing, transmission and distribution as natural monopolies, smart grids and new market mechanisms, and the economic impacts of large scale integration of renewable energy sources. Participation on lectures is not compulsory, but students are to answer to problem questions. As an exercise, students will be given a group work assignment that they are to work with throughout the duration of the course with the help of mentors. The subjects of the exercise is achieving climate goals and the future of energy systems.

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 32 h / student presentations 8 h, Guided group work: 8 h, individual homework 60 h/group work 42 h.

Target group:

Master's students of environmental engineering, especially of energy and environmental engineering orientation; Master's students in economics; Master's students of Electrical Engineering and Information Technology.

Prerequisites and co-requisites:

For Environmental Engineering students, admission to the Master's programme, for which minimally a former bachelor's degree is required. For other students the Bachelor level studies. A minimum of 10 ECTS worth of prior energy studies, bachelor level studies are acceptable. For example at Oulu: Sähkö- ja magnetismioppi, Production and use of energy, Fundamentals of nuclear energy.

Recommended or required reading:

Will be provided during the course by the lecturers.
Chen-Ching Liu, Stephern McArthur and Seung-Jae Lee (eds.)(2016) Smart Grids handbook, 3 volume set, and Stephen F. Bush (2014): Smart Grid: Communication-Enabled Intelligence for the Electric Power Grid. http://onlinelibrary.wiley.com/book/10.1002/9781118820216.

Assessment methods and criteria:

Answering problem questions and group exercise. Compulsory requirements are completing learning portfolio, answering of at least 75% of problem questions, participation in 50% of intermediate presentations and compulsory participation in the final presentation.

Grading:

The course evaluation will be based on an on-line learning portfolio and performance in the exercise participation and exercise report. The course unit utilizes a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.

Person responsible:

Docent Eva Pongrácz (EEE) and Prof. Maria Kopsakangas-Savolainen (OBS). Other lecturers: EEE: Dr. Antonio Caló, Dr. Jean-Nicolas Louis; OBS: Prof. Rauli Svento, Mari Heikkinen, Hannu Huuki, Santtu Karhinen, Enni Ruokamo; CWC: Dr. Pedro Nardelli.

Other information:

The number of students is limited. This course is a 5 credit course for engineering students, but economics students gain overall 6 credits by doing a mandatory extra assignment which corresponds to 1 credit.

488502S: Smart Grid II: Smart buildings/smart customers in the smart grid, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eva Pongracz

Opintokohteen kielet: English

ECTS Credits:

5 cr/150 hours of work

Language of instruction:

English

Timing:

Period 3

Learning outcomes:

The student is able to explain the concept of smart houses, and is able to demonstrate the optimization of smart house functions for energy efficiency, decarbonization and cost savings. Further, the student is familiar with the concepts and the technologies of smart house automation as well as other technologies used in smart houses such as smart appliances, smart metering and energy storage. The student will also understand the new role of consumers in the smart grid environment, their changing roles as well as current and future models of energy services. The student will also understand the risks of smart houses in terms of cyber security, data privacy and management. In addition, the student is able to outline the future perspectives of smart houses and smart consumers as part of the smart city framework and aiming toward eco-cities of the future.

Contents:

Multidisciplinary course, offered in cooperation of the Faculty of Technology (Energy and Environmental Engineering Research Unit - EEE), Oulu Business School (OBS, Department of Economics) and the Faculty of Information Technology and Electrical Engineering (Centre of Wireless Communication - CWC). After an introductory presentation on the course requirements, the basics are set in terms of defining smart houses as part of smart grids. Further the complementary roles of smart houses for energy efficiency, costs saving and decarbonization is explained. The key technologies of smart houses will be explained and demonstrated, including company presentations on existing commercial technologies and service models. In addition, the new role of consumers as prosumers and service users will be explained and demonstrated. There will be no exam, however, the students are to answer to problem questions related to the lectures and complete the exercises. There will be 4 exercises, concentrating on the 4 key themes of the course: smart house functions, smart house technologies, smart consumers, and energy services. Part of the exercises will be done as individual work that will be reported and some will be performed as group work. There will also be in-class guided exercises.

Mode of delivery:

Implemented as face-to-face teaching, visiting lectures and student presentations. The course largely relies on participatory learning, therefore, there are compulsory participation requirements.

Learning activities and teaching methods:

Lectures 28 h, student presentations 4 h, guided exercise work 24 h, individual work 50 h, group work 38 h.

Target group:

Master's students of environmental engineering, especially of energy and environmental engineering orientation; Master's students in economics; Master's students of Electrical Engineering and Information Technology. Doctoral students are also welcome to participate.

Prerequisites and co-requisites:

Completing Smart grids 1 course is preferred.

Recommended or required reading:

Will be provided during the course by the lecturers.
Chen-Ching Liu, Stephern McArthur and Seung-Jae Lee (eds.)(2016) Smart Grids handbook, 3 volume set, and Stephen F. Bush (2014): Smart Grid: Communication-Enabled Intelligence for the Electric Power Grid. http://onlinelibrary.wiley.com/book/10.1002/9781118820216.

Assessment methods and criteria:

Answering problem questions, individual and group exercise. Compulsory requirements are completing learning portfolio, answering of at least 75% of problem questions, compulsory participation in the in-course exercises and participation in the student presentation.

Grading:

The course evaluation will be based on an on-line learning portfolio, exercise performance and exercise report. The course unit utilizes a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.

Person responsible:

Prof. Eva Pongrácz (EEE) and Prof. Maria Kopsakangas-Savolainen (OBS). Other lecturers: EEE: Dr. Jean-Nicolas Louis; Dr. Antonio Caló, OBS: Prof. Rauli Svento, Santtu Karhinen...; CWC: Dr. Pedro Nardelli, Dr. Jussi Haapola, MSc. Florian Kühlenz.

Other information:

The number of students is limited. This course is a 5 credit course for engineering students, but economics students gain overall 6 credits by doing a mandatory extra assignment which corresponds to 1 credit.

488503S: Smart Grid III: Smart energy networks, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eva Pongracz

Opintokohteen kielet: English

ECTS Credits:

5 cr/135 hours of work

Language of instruction:

English

Timing:

Spring, period 4

Learning outcomes:

The student is able to explain the concept of energy transition, and is able to outline the structure and functioning of smart energy networks. Further, the student is familiar with the concepts of multi-vector energy networks, networks flow analysis, integration and synergy of multiple energy networks and. The student will also understand the concept of swarms of distributed energy generation and the need for storage to ensure network stability. The student will also able to outline the key energy storage methods and will be able to recommend them for distributed vs. centralized storage of both heat and electricity, for long term as well as short term. The student will also be able to use design tools for the planning and evaluation of future energy systems. The student will also be able to assess the dimensions of sustainability of smart energy networks.

Contents:

Multidisciplinary course, offered in cooperation of the Faculty of Technology (Energy and Environmental Engineering Research Unit - EEE), Oulu Business School (OBS, Department of Economics) and the Faculty of Information Technology and Electrical Engineering (Centre of Wireless Communication - CWC). After an introductory presentation on the course requirements, the basics are set in terms of defining energy transition to a carbon neutral energy future. Further the integration of multiple energy networks will be explained, as well as communication within multiple energy networks. The issue of swarms of distributed generation will be explained, as well as the economics of a system relying largely on renewables. The key storage technologies will be explained, demonstrating their use for heat or electricity storage, their effectiveness on small or large scale, as well as their purpose and economics of short and long term storage. Communication within the smart grid as well the economics of distributed generation in a future carbon neutral energy system will be explained. Finally, the sustainability assessment of smart energy network performance will be explained.
There will be no exam, however, the students will need to answer to problem questions related to the lectures and complete exercises. There will be 3 exercises, concentrating on (1) evaluation of storage technologies, (2) simulation of future smart energy networks and (3) sustainability assessment. The simulation work will be done as group work using the HOMER Energy software, for which in-class guidance will be provided. The results of the simulation will have to be presented. The rest will be done as individual work.

Mode of delivery:

Implemented as face-to-face teaching, visiting lectures and student presentations. The course largely relies on participatory learning, therefore, there are compulsory participation requirements.

Learning activities and teaching methods:

Lectures 28 h, student presentations 4 h, guided exercise work 24 h, individual work 50 h, group work 38 h.

Target group:

Master’s students of environmental engineering, especially of energy and environmental engineering orientation; Master’s students in economics; Master’s students of Electrical Engineering and Information Technology. Doctoral students are also welcome to participate.

Prerequisites and co-requisites:

Completing the course 488501S is a prerequisite, completing the course 488502S prior to this course is also recommended.

Recommended or required reading:

Will be provided during the course by the lecturers.
Chen-Ching Liu, Stephern McArthur and Seung-Jae Lee (eds.)(2016) Smart Grids handbook, 3 volume set, and Stephen F. Bush (2014): Smart Grid: Communication-Enabled Intelligence for the Electric Power Grid. http://onlinelibrary.wiley.com/book/10.1002/9781118820216.

Assessment methods and criteria:

Answering problem questions, individual and group exercise. Compulsory requirements are completing learning portfolio, answering of at least 75% of problem questions, compulsory participation in the in-course exercises and participation in the student presentation.

Grading:

The course evaluation will be based on an on-line learning portfolio, exercise performance and exercise report. The course unit utilizes a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.

Person responsible:

Prof. Eva Pongrácz (WE3) and Prof. Maria Kopsakangas-Savolainen (OBS). Other lecturers: WE3: Dr. Antonio Caló, Dr. Jean-Nicolas Louis; OBS: Enni Ruokamo; CWC: Doc. Jussi Haapola

Other information:

The number of students is limited. This course is a 5 credit course for engineering students, but economics students gain overall 6 credits by doing a mandatory extra assignment which corresponds to 1 credit.

488504S: Fundamentals of nuclear energy, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Antonio Calo

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits

Language of instruction:

English

Timing:

Autumn semester during the 1st period.

Learning outcomes:

Upon completion of the course, students can define the basic elements of nuclear power production and technology. They are thus able to describe the physical processes as well as the different components of a nuclear power plant. Students can also describe different elements of nuclear power technology deployment such as safety, environmental and health related issues.

Contents:

Basics of nuclear physics, fission and fusion; introduction to nuclear power technology and components of a nuclear power plant; history of nuclear power production; nuclear fuel cycle, mining and uranium extraction, enrichment, fuel temporary and permanent disposal; introduction to nuclear power plant design, safety and auxiliary system design; principles of nuclear safety and strategy of accidents prevention and management; principles of health physics, monitoring safety and prevention; introduction to nuclear power safety and safety culture.

Mode of delivery:

lectures

Learning activities and teaching methods:

Lectures 36h; mandatory work assignment and written final exam.

Target group:

Second year Master degree students; the course is open to all interested doctoral students.

Recommended or required reading:

lecture slides and information on recommended reading material will be provided during the course

Assessment methods and criteria:

Written final exam.

Grading:

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

Person responsible:

University researcher Antonio Caló

Other information:

The course will include a number of guest lecturers' contributions. When needed, lectures will happen through video conference. There might be the possibility for students located somewhere other than Oulu to attend the course via video conference as well. Such eventualities will have to be discussed and pre-arranged with the course organizers.

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 / 135 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during 3 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

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:

-

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

Opettajat: Jenö Kovács

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

Timing:

Period 3 (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 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

Working life cooperation:

No

Other information:

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H432233: Module of the Option/Cleaner Production, 30 op

Voimassaolo: 01.08.2017 -
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

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: Tiina Laitinen, Esa-Matti Turpeinen, 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 / 135 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 nd period.

Learning outcomes:

Student is able to explain what kind of air emissions originate from certain industries and power plants, and can explain their effects on environment and health. He/she can describe how air emissions are measured. Student is also aware of common air pollution control systems for different emissions (particulates, VOCs, SO2, NOx) and is able to design air pollution cleaning devices. In addition, the student is able to describe the main laws related to air emission control.

Contents:

Atmosphere and air pollutants. Air pollution effects and regulations. Emission measurements. General ideas in air pollution control. Emission control technologies; primary particulates, VOC emissions, SOx emissions, NOx emissions. Motor vehicle problem, CO, lead, HAP, Indoor air pollution, and radon.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h, exercises 12 h, homework 8 h, teamwork presentations 10 h, and self-study 75.

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 (or 477013P Introduction to Process and Environmental Engineering) 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 or intermediate exams.
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:

Postdoctoral researcher Satu Pitkäaho

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

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 / 135 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,...) 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. 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 beforehand.

Recommended optional programme components:

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Recommended or required reading:

Material represented in lectures and in the Optima environment.

Assessment methods and criteria:

Written final exam or 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:

Doctoral student Niina Koivikko

Working life cooperation:

No

Other information:

The course mainly consists of specific lectures presented by experts who are invited from industry.

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

Opettajat: Ahola, Juha Lennart

Opintokohteen kielet: English

Leikkaavuudet:

477206S	Advanced Process Design	6.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

Timing:

Spring, periods 3 and 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 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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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 /135 hours of work

Language of instruction:

English.

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

Prerequisites and co-requisites:

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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:

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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: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

470222A	Reactor Analysis and Design II	5.0 op

ECTS Credits:

5 ECTS / 135 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 ((i.e. multicomponent and multiphase 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 and computer simulations (CFD), face-to-face teaching.

Learning activities and teaching methods:

Lectures 30 h, exercises and simulation 14 h, homework 16 h, self-study 75 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:

Fogler, H. Scott: Elements of chemical reaction engineering. (5th edition) 2016. Prentice Hall PTR: Pearson Education International; Nauman, E.B.: Chemical Reactor Design. New York, John Wiley & Sons.1987;
Additional literature: Winterbottom, J.M. & King, M.B. (Editors) Reactor Design for Chemical Engineers. Padstow 1999, T.J. International Ltd. 442 s. 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:

Intermediate exams (2) or final 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:

University Lecturer Mika Huuhtanen

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.

Choose the other, Courses only every second year

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

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: Ainassaari, Kaisu Maritta

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 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 and visiting scientists.

Mode of delivery:

Face-to-face teaching and seminars.

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:

Docent Esa Muurinen

Working life cooperation:

No

Other information:

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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

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 credits/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 behind the most used purification processes in water and wastewater treatment. The student will also be capable of performing basic dimensioning calculations and therefore he/she will be able to dimension structures/units of water and wastewater treatment plants and to comprehend the basic requirements of different purification processes.

Contents:

Water quality characteristics of source water; basic principles of purification processes (coagulation/flocculation, sedimentation, biological treatment, filtration, disinfection, etc); process units in water and waste water treatment; selection of process units; dimensioning of treatment structures and unit processes.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (30 h), field visits (5 h), exercises and other assignments (60) and self-study (38 h).

Target group:

Students in Master program of Environmental Engineering and in master program of civil 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 (477013P) or I (477011P) and II (488010P)

Recommended optional programme components:

-

Recommended or required reading:

To be provided during the course.

Assessment methods and criteria:

The course can be completed in two different study modes: A) Active mode: midterm exam based on reading material + completion of 2 group exercises + final exam based on lectures and exercises; B) Passive mode (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. (Passive mode can be complete under special circunstances)
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:

Post-doctoral researcher Dr Elisangela Heiderscheidt

Working life cooperation:

Through visits to water and wastewater treatment plants, which include lectures provided by environmental engineers in charge and guided tours, the students familiarize with the main technological and process related principles of the field and have the chance to experience in first hand how to deal with some of the most common issues related to water and wastewater purification systems.

Other information:

-

488134S: Hydrogeology and groundwater engineering, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the spring semester, during period 3

Learning outcomes:

Upon completion of the course, the student will have knowledge on groundwater systems and the basic hydrogeological and engineering concepts involved. This includes analysis of flow in porous media, hydraulics of groundwater systems, groundwater quality and groundwater use. After the course students are able to estimate key factors influencing on groundwater recharge, flow and discharge and to use general methods to calculate groundwater flow.

Contents:

2D and 3D groundwater flow, conceptual models, unsaturated layer flow, water storage and retention, heterogeneity and isotropy, aquifer types, pumping tests, geophysical methods, groundwater quality and resources in Finland

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

lectures (18 h), calculus lectures (12 h), homework, exercises and self-study (103 h).

Target group:

Master students in the water engineering orientation of the Environmental Engineering program and in master program of civil engineering

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 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:

exam and/or lecture exams.

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:

Students familiarize themselves to a real groundwater aquifer cases discussed in lectures and in the course exercise.

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

Opettajat: Ali Torabi Haghighi

Opintokohteen kielet: English

Leikkaavuudet:

488118S	Laboratory Exercises and Field Measurements in Environmental Engineering	10.0 op

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, levelling, map and scale, different tests in soil mechanics laboratory.
Laboratory works in soil mechanics and geotechnical engineering: sieving test, hydrometer test, Atterberg limits test, proctor test, direct shear box test and oedometer test.
In the field: Working with GPS. Levelling and collecting data for preparing topography map. Soil sampling, surface water and groundwater sampling, Measuring velocity and discharge of river by using current meter and tracer.

Mode of delivery:

Face-to-face teaching, laboratory working

Learning activities and teaching methods:

Lectures (16 h), Fieldwork (20 h), Lab-work (9 h), Group work (88 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:

Two exams (40%), Report (50%) and assignments (10%), passing the exam is requirement for passing 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 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

Opettajat: Ali Torabi Haghighi

Opintokohteen kielet: English

Leikkaavuudet:

488118S	Laboratory Exercises and Field Measurements in Environmental Engineering	10.0 op

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:

Lectures (10 h), Lab-work (30 h), Group work (93 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

Other information:

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488135S: Water distribution and sewage networks, 5 op

Voimassaolo: 28.11.2016 - 31.07.2019

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: English

Leikkaavuudet:

488144A	Water distribution and sewage networks	5.0 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, in period 2

Learning outcomes:

Student knows and understands the systems and dynamics needed for water distribution and waste water networks. Student is able to do basic dimensioning for water distribution network and sewer system of an urban area.

Contents:

Water distribution and waste water network design and dimensioning, Pumping and storage tanks needed in distribution of water and collection of sewage waters, renovation of pipelines, special circumstances in water distribution, effects of cold climate and harmful hydraulic conditions.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (30 h), homework (45 h) and a design exercise (58 h).

Target group:

Students in master program of environmental engineering and in master program of civil engineering

Prerequisites and co-requisites:

Use of AutoCAD-program

Recommended optional programme components:

The recommended prerequisite is the completion of the following course prior to enrolling for the course unit: 477052A Virtaustekniikka, 477312A Lämmön- ja aineensiirto 488102A Hydrological Processes and 488051A AutoCAD ja Matlab prosessi- ja ympäristötekniikan työkaluna or at least equivalent information about water management.

Recommended or required reading:

Lecture handout and other materials delivered in lectures. To the appropriate extent: RIL 237-1-2010 Vesihuoltoverkkojen suunnittelu, RIL 237-2-2010 Vesihuoltoverkkojen suunnittelu, RIL 124-2 Vesihuolto II, Mays Water distribution systems handbook

Assessment methods and criteria:

Exam and a design exercise.

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:

Visit to a site of water distribution network buiding site, pumping station or water supply/sewerage company.

488136S: Integrated water resources management, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the autumn semester, in period 1

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 in nordic and global perspectives.

Contents:

Different water uses and interests, hydropower and dam engineering, irrigation and drainage, flood control and management, restoration cases, sedimentation problems, land use management, water protection, optimization and simulation, socio-ecological aspects in water resources.

Mode of delivery:

Face-to-face teaching, assignments, exam

Learning activities and teaching methods:

Variable learning methods: Lectures, assignments, exam

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 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: More detailed instructions will be given in the course.

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:

The course includes the real life examples from Water Resources Management issues.

Other information:

The course is arranged in alternate years (odd years in the autumn semester).

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: Anssi Rauhala

Opintokohteen kielet: Finnish

Leikkaavuudet:

485306S	Geoenvironmental Engineering	5.0 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

Finnish and option complete in English

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 technique for 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, Structures of dams and inpoundments, Challenges of mining, Remote sensing as a part of geotechnical applications.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (44 h), group work (60 h) and independent work (31 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 (substitute: researcher Anssi Rauhala)

Working life cooperation:

The course includes a visit to the Rusko waste center and also guest lectures from professionals in industry and administration.

Other information:

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Choose water or geo engineering (Geo Engineering is in Finnish)

H432234: Module of the Option/Water Engineering, 25 op

Voimassaolo: 01.08.2017 -

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.

Choose 25 ECTS

488137S: Statistical hydrology, 5 op

Voimassaolo: 28.11.2016 - 31.07.2020

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannu Marttila

Opintokohteen kielet: English

Leikkaavuudet:

488145S	Data analysis for Water Resources	5.0 op

ECTS Credits:

5 ECTS credits/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 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))

Grading:

Final grade of the course is average of assignments and final exam. In the numerical scale zero stands for a fail.

Person responsible:

Postdoctoral Researcher Pertti Ala-aho

Working life cooperation:

The course includes handling of real data and handling of typical problems in water engineering

Other information:

The course is arranged in alternate years (odd years in the autumn semester).

488138S: Cold climate hydrology, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Anna-Kaisa Ronkanen

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course is held in the autumn semester during the period 2

Learning outcomes:

After completing the course, the students had deepened their knowledge on processes effecting snow accumulation, melt and runoff. They are able to use computational methods to study runoff-rainfall processes and are able to apply isotope hydrological tools in e.g. hydrograph separation and calculate age of groundwater. Furthermore they deepen their knowledge in hydrological analysis of hydrological pathways, evapotranspiration, infiltration to frozen ground, temporal and spatial variability of climate and hydrology.

Contents:

Hydrological processes, evapotranspiration, climate variability and extreme events, rainfall-runoff modeling, snow hydrology, soil frost and ice, environmental tracer hydrology, isotope hydrology.

Mode of delivery:

Face-to-face teaching and independent work with assignments.

Learning activities and teaching methods:

Lectures 18 h / independent process studies, modelling and homeworks 115 h. Totally 133 h.

Target group:

Master students in Water resources and environmental engineering major in the Environmental Engineering Master 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 hydrology

Recommended or required reading:

Delivered 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

Other information:

The course is arranged in alternate years (even years in the autumn semester).

488139S: Surface water quality modelling, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Anna-Kaisa Ronkanen

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course is held in the autumn semester during the period 2

Learning outcomes:

After completing the course, the students are able to estimate point and diffusion load from catchment to lakes or rivers and are familiar with basic limnology of these water systems. The students are also able to analyse water systems using mathematical modelling and understand main pollutant transport mechanisms so that are able to model water quality in lakes and streams. They also understand key concepts of surface water systems, and how to control nutrient and pollutant processes. The students are able to use Matlab in environmental analysis, modeling and programming.

Contents:

Modelling in water resources planning, environmental hydraulics, open channel flow, diffusive and point loading, limnology, processes and water quality, dimensional analysis, hydraulic experiments, transport of conservative and reactive solutes in water bodies. 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 26 h / guided exercises by Matlab 16 h / self-studies 91 h. Totally 133 h.

Target group:

Master students in Water resources and environmental engineering major in the Environmental Engineering Master 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 the exam and assignments.

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

Other information:

The course is arranged in alternate years (even years in the autumn semester).

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 software, River stability and flood control structure, Conveyance structures, Water storage structures, Protective structures, Regulating structures, Water measurement structures, Energy Dissipaters, Design small hydraulic structures

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (24 h), group work (36 h), independent work (29 h), self-study (29 h) and seminar (15 h)

Target group:

Students in Master programs of environmental engineering and civil engineering

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the following course or having corresponding knowledge prior to enrolling for the course unit: 477052A Fluid mechanics and 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:

Technical project (Using Hec-Ras for flood control Project) (30%), assignment (15%), river engineering report (15%), two exams (50%).
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 arranged in alternate years (even years in the autumn semester).

488140S: Groundwater modelling and management, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pertti Ala-Aho

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the spring semester, during period 4

Learning outcomes:

Upon completing the course, the student is able to analyze and model groundwater systems and considering various apects of management. The student is familiar with basic groundwater modelling concepts and tools. From different groundwater case studies, students will gain knowledge on ecological, social and economic aspects of groundwater management.

Contents:

Grid based modelling, solute transport, model uncertainties, groundwater management questions, groundwater dependent ecosystems, groundwater and cold climate

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (20 h), modelling work (25 h) and self-study and report (88 h).

Target group:

Master students in the water engineering orientation 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: 488134S Hydrogeology and groundwater engineering, 031022P Numerical Methods

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, report and presentation for project work.

Grading:

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

Person responsible:

Postdoctoral Researcher Pertti Ala-aho

Working life cooperation:

Students get experience on modeling software used in the consulting industry, and familiarize themselves to complex real-life groundwater management cases.

488143S: Environmental Impact Assessment, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannu Marttila

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course is held in the autumn semester during the 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 and project work

Learning activities and teaching methods:

The amount of lecture hours can varied depending teaching resources in every year but independent project working is the main activities in the course. Work load in the course is totally 133 h. The project work is completed as group work.

Target group:

Only master students in Water resources and environmental engineering major in the Environmental Engineering Master Program

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 assignment (60 %) and seminar (40%). More information about assessment methods 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:

Docent Hannu Marttila

Working life cooperation:

The course includes the guest lectures from local companies and authorities. The assignment is based on case studies that are rael on-going or passed EIA projects.

Other information:

Maximum number of the students in the course is 20.

488141S: Urban hydrology, 5 op

Voimassaolo: 28.11.2016 - 31.07.2020

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: English

Leikkaavuudet:

488146S	Urban water management	5.0 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the spring semester, in period 3

Learning outcomes:

Student has a knowledge on the different aspects of urban hydrology to manage waters in a built environment. Student understands the challenges concerning quantity and quality questions of urban waters and can take them into account in designing.

Contents:

Storm water system design, green infrastructure, urban erosion, drainage, flood control and climate change in urban hydrology, urban water quality and constructed wetlands.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (30 h), homeworks (45 h) and a design exercise (58 h).

Target group:

Students in master program of environmental engineering and in master program of civil engineering

Prerequisites and co-requisites:

Use of AutoCAD-programs. This course is a straight continuation of course 488135A Water distribution and sewage networks (recommended but not prerequisite prior to this course).

Recommended optional programme components:

The recommended prerequisite is the completion of the following course prior to enrolling for the course unit: 477052A Fluid mechanics, 477312A Lämmön- ja aineensiirto 488102A Hydrological Processes and 488051A AutoCAD ja Matlab prosessi- ja ympäristötekniikan työkaluna or at least equivalent information about water management.

Recommended or required reading:

Lecture handouts, Hulevesiopas (2012, in Finnish)

Assessment methods and criteria:

Examination, seminar and a design exercise.

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:

Course includes guest lectures of storm water designers/consultants and/or municipalities/cities responsible for the storm water management.

H432235: Module of the Option/Geo Engineering, 25 op

Voimassaolo: 01.08.2017 -

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.

Choose 25 ECTS

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

Opettajat: Anssi Rauhala

Opintokohteen kielet: Finnish

Leikkaavuudet:

485305S	Modelling in Geoenvironmental Engineering	5.0 op

ECTS Credits:

5 ECTS credits/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. Geotechnical design of pile foundation.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (10 h), design (58 h) and modelling assignments (65 h).

Target group:

Master’s students in the study option of Water and Geoenvironmental Engineering

Prerequisites and co-requisites:

The required prerequisite: 488115A Geomechanics. Also recommended: 488051A AutoCAD and Matlab in Process and Environmental Engineering, 488121S Fundamentals of Civil Engineering, 488129S Foundation Engineering, 488131S Geoenvironmental Engineering.

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout and other materials delivered in lectures

Assessment methods and criteria:

Passing the course requires solving the given assignments and writing reports about them. The assignments are solved with computer modelling, which requires constant participation to the lectures.

Grading:

The course utilizes verbal grading scale pass/fail.

Person responsible:

University teacher Anne Tuomela (substitute: researcher Anssi Rauhala)

Working life cooperation:

The course includes guest lectures from an international consulting and engineering company.

Other information:

-

488129S: Foundation Engineering, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Veikko Pekkala

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay485302A	Foundation Engineering (OPEN UNI)	5.0 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

5 ECTS credits / 132 hours of work

Timing:

The course unit is held in the autumn semester during period 2

Learning outcomes:

After completing the course, students can choose the right foundation type and design shallow and deep foundations. After completing the course the student is also able to design earth retaining structures, drainage and frost protection.

Contents:

The following topics are covered during the course: The basis of geotechnical and structural design of foundations. Foundation types and foundation construction. Piles and piled foundations. Ground bearing slabs. Gravity and embedded walls. Ground improvement. Drainage. Frost protection.

Mode of delivery:

Lecture room teaching.

Learning activities and teaching methods:

Lectures and exercises

Target group:

Master's students of environmental and civil engineering

Prerequisites and co-requisites:

Recommend course 488115A Geomechanics

Recommended or required reading:

1. Lecture material.
2. RIL 254-2016, Paalutusohje
3. RIL 263-2014 Kaivanto-ohje
4. Decoding Eurocode 7 (2008), Bond, A. and Harris, A., Taylor & Francis, (Contents are informed during lectures).

Assessment methods and criteria:

Passed practical works and exam

Grading:

Rating scale 1-5

Person responsible:

Researcher Veikko Pekkala

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: Anssi Rauhala

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits/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, soil improvement, excavations, Property and surface drainage, lowering of groundwater table. Pipeline Construction. Specialities of railway construction and vibration problems.

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 (91 h)

Target group:

Master students in the Water and Geo Engineering study option of the Environmental Engineering program

Prerequisites and co-requisites:

Prerequisites: 488115A Geomechanics, 477032A AutoCAD and Matlab in process and environmental engineering (or similar AutoCAD knowledge)

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:

University teacher Anne Tuomela (substitute: researcher Anssi Rauhala)

Working life cooperation:

The course includes guest lectures from various sectors of civil engineering.

Other information:

-

488140S: Groundwater modelling and management, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pertti Ala-Aho

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the spring semester, during period 4

Learning outcomes:

Upon completing the course, the student is able to analyze and model groundwater systems and considering various apects of management. The student is familiar with basic groundwater modelling concepts and tools. From different groundwater case studies, students will gain knowledge on ecological, social and economic aspects of groundwater management.

Contents:

Grid based modelling, solute transport, model uncertainties, groundwater management questions, groundwater dependent ecosystems, groundwater and cold climate

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (20 h), modelling work (25 h) and self-study and report (88 h).

Target group:

Master students in the water engineering orientation 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: 488134S Hydrogeology and groundwater engineering, 031022P Numerical Methods

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, report and presentation for project work.

Grading:

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

Person responsible:

Postdoctoral Researcher Pertti Ala-aho

Working life cooperation:

Students get experience on modeling software used in the consulting industry, and familiarize themselves to complex real-life groundwater management cases.

488141S: Urban hydrology, 5 op

Voimassaolo: 28.11.2016 - 31.07.2020

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: English

Leikkaavuudet:

488146S	Urban water management	5.0 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

The course unit is held in the spring semester, in period 3

Learning outcomes:

Student has a knowledge on the different aspects of urban hydrology to manage waters in a built environment. Student understands the challenges concerning quantity and quality questions of urban waters and can take them into account in designing.

Contents:

Storm water system design, green infrastructure, urban erosion, drainage, flood control and climate change in urban hydrology, urban water quality and constructed wetlands.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (30 h), homeworks (45 h) and a design exercise (58 h).

Target group:

Students in master program of environmental engineering and in master program of civil engineering

Prerequisites and co-requisites:

Use of AutoCAD-programs. This course is a straight continuation of course 488135A Water distribution and sewage networks (recommended but not prerequisite prior to this course).

Recommended optional programme components:

The recommended prerequisite is the completion of the following course prior to enrolling for the course unit: 477052A Fluid mechanics, 477312A Lämmön- ja aineensiirto 488102A Hydrological Processes and 488051A AutoCAD ja Matlab prosessi- ja ympäristötekniikan työkaluna or at least equivalent information about water management.

Recommended or required reading:

Lecture handouts, Hulevesiopas (2012, in Finnish)

Assessment methods and criteria:

Examination, seminar and a design exercise.

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:

Course includes guest lectures of storm water designers/consultants and/or municipalities/cities responsible for the storm water management.

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

Opettajat: Hiltunen, Jukka Antero

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 (**=** min. 2 months working full-time)
Language of instruction:
Finnish or English
Timing:
Student usually works during the summer time between the 1st and 2nd academic year of the Master's degree.
Learning outcomes:
The objective is to get a deeper and more detailed conception of the industrial area where the student will possibly work after graduation. After the advanced practical training working period, the student is able to tell about their potential future jobs either in a new position or in an already familiar work environment. The student is able to identify and solve problems in work environment. Students are able to apply the theoretical knowledge they have learned in practical tasks. The student recognizes the diploma engineer's duties from his or her workplace.
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:
Practical training (internship) is usually carried out as a regular employee, to prepare the student for his/her possible future tasks in a leading, guiding, and/or planning position. In addition the student will be in touch with practical work and occupational safety issues, as well as the individual and social nature of the workplace. In addition to the training, the student is also required to prepare a CV and give a seminar presentation on his/her training.
Learning activities and teaching methods:
Students must 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, e.g. supervision tasks and R&D tasks.
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 as an employee (of minimally 2 months of full time work), and giving an oral seminar presentation to report the summer job. Student also has to show his/her original references (job certificates) and his/her cv, and submit an application form to the supervisor of the seminar. The reference must include the training period (from - to) and the duties. Advanced practical training cannot be substituted with jobs the student has performed before his/her Master's studies.
Grading:
Verbal scale Passed/Failed
Person responsible:
Jukka Hiltunen
Working life cooperation:
Yes
Other information:
-

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.

Compulsory; this module is suitable for the students of Processmetallurgy either advanced or supplementary module

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

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

ECTS Credits:

5 ects/135 hours study time

Language of instruction:

Finnish

Timing:

Lectures and laboratory works, 3 and 4 periods

Learning outcomes:

The aim of the course is to introduce the common physical (metallurgical) phenomena in metal alloys and other construction materials. He/she understands the effect of different microstructural features on the mechanical properites and the processibility of the above mentioned materials. Finally, he/she is familiar with typical non-destructive and destructive testing techniques in material science.

Contents:

Solidification and phase transformations, plastic deformation, static recovery and recrystallization, effect of microstructure on mechanical properties of metal alloys, typical corrosion mechanisms, fatigue in metal alloys, creep in metal alloys, and non-destructive and destructive material testing.

Mode of delivery:

Face-to face teaching

Learning activities and teaching methods:

32 hours lectures/ 12 hours laboratory exercises/91 hours indepedent studies. Three laboratory excersises are included in the course.

Prerequisites and co-requisites:

None

Recommended or required reading:

Lecture booklet (In Finnish). Other material will be announced at the beginning of the course.

Assessment methods and criteria:

Final exam. The final grade is based on the final exam.

Grading:

Numerical grading scale 1 - 5. Laboratory exercises will be graded as "pass"/"fail".

Person responsible:

Olli Nousiainen

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

Opettajat: Anna Kisko

Opintokohteen kielet: Finnish

Language of instruction:

Finnish

Timing:

Lectures and materials selection exercise take place during the periods 1 and 2, autumn term.

Learning outcomes:

The objective of the course is to familiarize the student with basic matters concerning properties of metallic and non-metallic structural materials, the area within which the materials are in use, and the principles of materials selection. After the course, the student is able to classify different structural materials such as steels, cast irons, non-ferrous metals, polymer based materials and structural ceramics. The student masters structural materials and their selection so that he/she is able to select the most proper structural material for a product or component.

Contents:

Common structural materials in mechanical engineering, including steels (structural, QT, tool, stainless), cast irons, non-ferrous metal alloys (aluminium, titanium, magnesium, copper, nickel) and polymer based materials (structural plastics, plastics composite, elastomers, rubbers). Materials selection taking into account different demands. Ashby diagrams.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

The course is made up of lectures (32 h) and a materials selection exercise in small group during the periods 1 and 2.

Prerequisites and co-requisites:

Reommended: 465101A Introduction to Materials for Mechanical Engineering.

Recommended or required reading:

Lecture booklet (in Finnish); Exercise materials

Assessment methods and criteria:

The final grade is based on the combined points from materials selection exercise (0,2) and exam (0,8).

Grading:

Numerical grading scale 1-5 / fail.

Person responsible:

Olli Nousiainen

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

ECTS Credits:

5 ects/ 135 hours study time

Language of instruction:

Finnish

Timing:

Lectures and laboratory works, 1. period

Learning outcomes:

The aim of the course is to introduce common crystal structures in metal alloys. A student knows how to describe crystal planes and crystal directions of a cubic crystal structure using Miller indices. He/she also understands the interactions between x-ray radiation (or electronic beam) and metallic specimen. Finally, he /she is able to analyze data obtained from XRD, SEM/EBSD and TEM studies.

Contents:

Crystal strucrture, bonding types, reciprocal lattice, XRD, SEM/EBSD, and TEM.

Mode of delivery:

Face-to face teaching

Learning activities and teaching methods:

32 hours lectures/ 12 hours laboratory exercises/91 hours independent studies. Three laboratory excersises are included in the course.

Prerequisites and co-requisites:

465101A Introduction to materials for mechanical engineering and 465102A Materials for mechanical engineering.

Recommended or required reading:

Lecture booklet (In Finnish). Other material will be announced at the beginning of the course.

Assessment methods and criteria:

Final exam and final report. The final grade is based on the combined points from the exam (factor 0.7) and the report (factor 0.3).

Grading:

Numerical grading scale 1 - 5.

Person responsible:

Olli Nousiainen

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: Jukka Kömi

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

ECTS Credits:

5 ECTS/135 h study time

Language of instruction:

Finnish

Timing:

Autumn semester period 1. Recommended for 5 th year of studies.

Learning outcomes:

After completion of the course, the student will be able to list the main production stages in the steel production and name the most important factors affecting steel quality. (S)he will be able to explain the metallurgical phenomena involved in heat treatments and thermomechanical treatments, especially those concerned with grain refinement. (S)he will be able to name important steel types and describe their main properties and development trends. (S)he will be able to explain the factors that affect the formation of inclusions and the effects of inclusions on steel properties.

Contents:

Production of liquid steel, ladle treatments, continuous casting, rolling. Heat treatment and thermomechanical treatments and their effects on properties. Dynamic restoration mechanisms. Different steel types, their properties and applications. Inclusions and their effects on toughness, fatigue strength, machinability and surface quality.

Mode of delivery:

Face to face

Learning activities and teaching methods:

Lectures 32 h / independent study 103 h.

Target group:

Compulsory in the master's stage for all Mechanical Engineering students majoring in Materials Engineering.

Prerequisites and co-requisites:

Before registering for this course the student must have successfully completed the following courses: 465101A An Introduction to Materials for Mechanical Engineering, 465102A Materials for Mechanical Engineering, 465107A An Introduction to Physical Metallurgy.

Recommended or required reading:

Study guide and lecture presentations.

Assessment methods and criteria:

Final grade assessed on the basis of a final examination.

Grading:

Pass grades on a scale of 1-5. Grade 0 fail.

Person responsible:

Professor Jukka Kömi

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: Anna Kisko

Opintokohteen kielet: Finnish

Leikkaavuudet:

465075A	Research Techniques for Materials	3.5 op

ECTS Credits:

5 ects/ 135 hours study time

Language of instruction:

Finnish

Timing:

Lectures and laboratory works, 2. period

Learning outcomes:

This course gives an introduction to the broad spectrum of experimental techniques used in materials research, excluding materials testing. The principles, advantages and limitations of the various methods and their field of applications are described. Upon completing of the required coursework, the student can explain the structure, functioning and contrast formation as well as factors affecting the resolution of various metal microscopes. He/she is also able to explain the concepts of the thermal analysis, dilatometry, and magnetic and electrical measurements and list typical applications for these techniques and methods.

Contents:

Optical microscopy, scanning electron microscope (SEM), microanalysis techniques (EDS and WDS), atom force microscopy, dilatometry, thermal analysis techniques, magnetic measurement techniques, surface analysis techniques, and bulk analysis techniques.

Mode of delivery:

Face-to face teaching

Learning activities and teaching methods:

32 hours lectures/ 12 hours laboratory exercises/91 hours independent studies. Three laboratory excersises are included in the course.

Recommended or required reading:

Lecture booklet (In Finnish). Other material will be announced at the beginning of the course.

Assessment methods and criteria:

Lecture booklet (In Finnish). Other material will be announced at the beginning of the course.

Grading:

Numerical grading scale 1 - 5

Person responsible:

Olli Nousiainen

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: Jukka Kömi

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

Assessment methods and criteria:

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

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: Jukka Kömi

Opintokohteen kielet: Finnish

Leikkaavuudet:

465110S	Strength of metallic alloys	7.0 op
465081S	Physical Metallurgy I	7.0 op

Assessment methods and criteria:

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

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: Timo Kauppi

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

ECTS Credits:

8 cr / study time 216 h

Language of instruction:

Finnish

Timing:

Lectures (48 h) during the period 3, laboratory exercise continues during the period 4.

Learning outcomes:

The course gives essential background information on the phenomena taking place in welding and their influence on microstructures and mechanical properties and also provides skills in select materials and welding methods. Learning outcomes: Upon completing of the required coursework, student is able to:
-explain the influence of welding conditions on temperature distribution and solidification morphology of a welded joint,
-classify typical microstructures present in the heat-affected zone of low carbon steel weldments,
-compare the importance of microstructure on mechanical properties of the joint, and
-explain the microstructure changes occurring in welding of alloyed steels, cast irons and non-ferrous metals and their influence on properties.
After the course the student also has skills to select a proper weldability test for estimating the risk of cold and hot cracking.

Contents:

Heat distribution in welded joints; Solidification and segregation; Microstructures of the heat-affected zone; Weldability: structural steels, low-alloyed steels, stainless steels, cast irons, nonferrous metals; Welding defects and weldability testing.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

This course consists of 48 hours of lectures during the 3rd period, a seminar and a laboratory exercise with reporting.

Prerequisites and co-requisites:

465104A Heat treatment and welding of metals

Recommended or required reading:

Lecture notes (mainly in Finnish). Kou, S.: Welding Metallurgy, Wiley Co, New York 1987. Easterling K.: Introduction to the Physical Metallurgy of Welding, Butterworths & Co Ltd, London, 1983 Kyröläinen A ja Lukkari J., Ruostumattomat teräkset ja näiden hitsaus, MET, 1999

Assessment methods and criteria:

The final exam or midterm exams and the final grade is based on the exam (weight 0,8) and an exercise report (weight 0,2).

Grading:

Numerical grading scale 1-5.

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

Opintokohteen kielet: Finnish

Leikkaavuudet:

465079S	Failure Analysis	3.5 op

ECTS Credits:

5 ECTS/135 h study time

Language of instruction:

Finnish

Timing:

Spring semester, period 4. Recommended for fourth year of studies.

Learning outcomes:

After completion of the course, the student will be able to explain the effects of mechanical and environmental loads on the possible failure mechanisms in alloys. (S)he will be able to avoid unsuitable choices of materials in various applications. (S)he will be able to list the stages involved in a typical failure analysis. The student will be able to determine the most likely failure mechanism on the basis of the macroscopic and microscopic features of fracture surfaces. (S)he will be able to give rational instructions for avoiding failures. (S)he will be able to plan tests to measure fatigue and creep resistance.

Contents:

Failure mechanisms at low and high temperatures under static and dynamic loading. Failures caused by corrosion. Macroscopic and microscopic features of fracture surfaces. General principles and approaches to failure analysis. Practical examples of failure cases. Fatigue and creep testing.

Mode of delivery:

Face to face

Learning activities and teaching methods:

Lectures 32 h / independent study 103 h.

Target group:

Compulsory in the masters stage for all Mechanical Engineering students majoring in Materials Engineering.

Prerequisites and co-requisites:

Before registering for this course the student must have successfully completed the following courses: 465101A An Introduction to Materials for Mechanical Engineering, 465102A Materials for Mechanical Engineering, 465107A An Introduction to Physical Metallurgy.

Recommended or required reading:

Study guide and lecture slides. Additional material: Wulpi, D.J.: Understanding How Components Fail, ASM 1985. Engel L. and Klingele H.: Atlas of Metals Damage, Carl Hauser Verlag.

Assessment methods and criteria:

Final grade assessed on the basis of final examination.

Grading:

Pass grades on a scale of 1-5. Grade 0 fail.

Person responsible:

Professor Jukka Kömi

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

ECTS Credits:

10 ects/270 hours study time

Language of instruction:

Finnish

Timing:

Lectures and laboratory works, I and II periods

Learning outcomes:

The target for the course is for the student to gain knowledge of the basic concepts of the rolling technology, the basic character of the rolling process and some special characteristics also which are related to it. Upon completing the required coursework, the student can explain the effects of hot rolling and cold rolling on the quality of the final product. With the help of the learned theory, the student can explain the significance of the process modeling on the control of the rolling process. Furthermore, the student understands the connection between rolling and materials engineering and can estimate their effect on the manufacturing process and on the quality of the final product.

Contents:

Concepts of the rolling technology and terminology; Basics of the plasticity theory; Calculation of roll force and characteristics of roll gap; Temperature behavior during rolling; Flatness and profile analysis; Accuracy of manufacturing and its statistical applications; Modeling of the rolling process.

Mode of delivery:

Face-to face teaching

Learning activities and teaching methods:

50 hours lectures/ 30 hours laboratory exercises/190 hours independent studies. Three laboratory excersises are included in the course.

Recommended or required reading:

Lecture booklet (In Finnish). Starling: Theory and practise of flat rolling

Assessment methods and criteria:

Final exam.

Grading:

Numerical grading scale 1 - 5.

Person responsible:

Jussi Paavola

A432257: Supplementary Module, Traffic Engineering, 5 - 60 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Electives

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:

-

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

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

Other information:

-

A432258: Supplementary Module, Structural Engineering, 5 - 60 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Supplementary Module
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Electives

461102A: Statics, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Mechanical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Lahtinen, Hannu Tapio
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay461102A	Statics (OPEN UNI)	5.0 op
461016A-01	Statics, examination	0.0 op
461016A-02	Statics, exercises	0.0 op
461016A	Statics	5.0 op

ECTS Credits:

5 ETCS / 149 hours of work

Language of instruction:

Lectures in finnish, foreign students follow the course by reading independently the books in english and taking part to the exercises and exams where all material is given in english.

Timing:

The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 1st autumn semester.

Learning outcomes:

After the course, the student can calculate forces and moments of loaded structures using equations of vector algebra and trigonometry. He/she can draw a free body diagram of the force system and then solve the unknown forces by using equations of equilibrium. He/she can determine resultants from uniformly distributed loads and apply Coulomb's law of friction in the problem equilibrium. The student can solve problems of internal and external forces of particle systems and rigid body systems in case of static equilibrium. Especially, he/she can draw shear force and bending moment diagrams for beam structures.

Contents:

Fundamental laws and concepts in statics. Force systems and their treatment. Equilibrium of particles and rigid bodies. Static forces in isostatic structures such as beams, frames, cables and trusses. Friction.

Mode of delivery:

Implemented as Face-to-face -teaching.

Learning activities and teaching methods:

Lectures 55 h / exercises 42 h / independent work of solving homework problems 52 h.

Target group:

Compulsory for candidate degree students of mechanical engineering programme.

Prerequisites and co-requisites:

Now prerequisites required.

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:

Salmi, T.: Statiikka, Pressus Oy, Tampere 2005; Beer, F., Johnston, R.: Vector Mechanics for Engineers, Statics, McGraw-Hill Book Company, 1996.

Assessment methods and criteria:

In the course acceptable homework and midterm exams / final exam are required. This course utilizes continuous assessment. There are four midterm exams, of which the last one is at the same time a final exam. Homework contain every week three problems that are marked. The student is allowed to participate to a final exam, when the homework is accepted.

Grading:

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

Person responsible:

University teacher Hannu Lahtinen

Other information:

The course gives ability for understanding static equilibrium, ability for determining force balance in structures and readiness for later studies.

461103A: Strength of materials I, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Lahtinen, Hannu Tapio

Opintokohteen kielet: Finnish

Leikkaavuudet:

461010A-01	Strength of Materials I, examination	0.0 op
461010A-02	Strength of Materials I, exercises	0.0 op
461010A	Strength of Materials I	7.0 op

ECTS Credits:

5 ETCS / 149 hours of work

Language of instruction:

Lectures in Finnish, foreign students follow the course by reading independently the books in English and taking part to the exercises and exams where all material is given in English.

Timing:

The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 1st spring semester.

Learning outcomes:

After the course, the student can determine stresses and strains of structures under loading. He/she can change the general stress and strain states from one coordinate system to another and can also apply constitutive equations in calculations. The student can dimension typical structures such as tension and compression bars, torsion bars and straight beams.

Contents:

Purpose and goals of strength of materials. Experimental elastic properties and strength of steel. Tension and compression of straight bars. Round torsion bar under shear force and torsion loads. Stresses and deflection curves in straight beams under bending moments. Stress state, strain state and constitutive equations, principal stresses, Mohr's circle. Stress hypotheses.

Mode of delivery:

Implemented as Face-to-face -teaching.

Learning activities and teaching methods:

Lectures 55 h / exercises 42 h / independent work of solving homework problems 52 h.

Target group:

Compulsory for Bachelor's degree students of mechanical engineering programme.

Prerequisites and co-requisites:

The recommended preceding course is 461102A Statics.

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:

Salmi, T., Pajunen, S.: Lujuusoppi, Pressus Oy, Tampere, 2010, Pennala, E.: Lujuusopin perusteet, Moniste 407, Otatieto 2002; Karhunen, J. & al.: Lujuusoppi, Otatieto 2004; Beer, F., Johnston, E., Mechanics of materials , McGraw-Hill, 2011; Gere, J.M., Timoshenko, S.P., Mechanics of Materials, Chapman&Hall, 1991.

Assessment methods and criteria:

In the course acceptable homework and midterm exams / final exam are required. This course utilizes continuous assessment. There are four midterm exams, of which the last one is at the same time a final exam. Homework contain every week three problems that are marked. The student is allowed to participate to a final exam, when the homework is accepted.

Grading:

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

Person responsible:

University teacher Hannu Lahtinen

Other information:

The course looks into the most important principal concepts of strenght of materials and gives ability for dimensioning of simple structures such as straight bars in tension, compression or torsion loads and straight beams under bending moments.

466101A: Introduction to building construction, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Liedes, Hannu Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

485101A Introduction to building construction 5.0 op

460116A-01 Introduction to Contruction Engineering, examination 0.0 op

460116A-02 Introduction to Contruction Engineering, exercise work 0.0 op

460116A Introduction to Building Construction 3.0 op

ECTS Credits:

5 ECTS credits / 132 hours of work

Language of instruction:

Finnish

Timing:

Spring, periods 3-4

Learning outcomes:

After completing the course students can describe the construction process, different parties of a construction project and their role in the project. Students can also explain how laws and legislation affects the construction, design and production of building structures. They can describe the material properties of the most common construction materials. They can also explain the certification process of a building material or product and the environmental legislation in construction.

Contents:

The following topics are covered during the course: Construction law and legislation. Different phases of a construction project. The raw materials, production and properties of the most common construction materials and products. Quality assurance and certification of building products. Environmental declarations. Life cycle assessment.

Mode of delivery:

Lecture room teaching.

Learning activities and teaching methods:

Lectures and exercises

Target group:

Students studying structural engineering

Recommended or required reading:

Lecture material. Land use and building legislation. The National Building Code of Finland

Assessment methods and criteria:

Passed practical works and exam

Grading:

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

Person responsible:

University teacher Hannu Liedes

466107S: Design of concrete structures, 6 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Antti Niemi

Opintokohteen kielet: Finnish

Leikkaavuudet:

485106A Design of concrete structures 5.0 op
460147A Introduction to Design of Concrete Technology 4.0 op
460147A-01 Introduction to Design of Concrete Technology, examination 0.0 op
460147A-02 Introduction to Design of Concrete Technology, exercise work 0.0 op
460148S Design of Concrete Structures 4.0 op
460148S-01 Design of Concrete Structures I, examination 0.0 op
460148S-02 Design of Concrete Structures I, exercises 0.0 op

ECTS Credits:

6 ECTS /162 hours

Language of instruction:

Finnish

Timing:

Lectures and exercising on periods 3 and 4.

Learning outcomes:

Upon completion of the course, the student will be able to design typical reinforced concrete structures to EN-standards.

Contents:

Strength and strain properties of concrete and reinforcing bars, time dependent properties. Limit state design of concrete beams and columns to EN standards. Service life design. Fire design. Anchoring and joints of reinforcing bars. Design of flanged cross sections, walls and wall like beams, and foundations carrying walls and columns.

Mode of delivery:

face-to-face teaching.

Learning activities and teaching methods:

Lectures and exercising 54 hours including personal and team work. Self-reliant studying and homework 108 hours.

Target group:

Master level students focusing on structural engineering and design.

Prerequisites and co-requisites:

Recommended good skills in: Statics, strength of materials, structural mechanics of beam and plated structures. Basics in concrete technology and structural design.

Recommended or required reading:

Nykyri: BY211 Betonirakenteiden suunnittelun oppikirja, osa 1, 2013 ja osa 2, 2015; Leskelä: By210 Betonirakenteiden suunnittelu ja mitoitus 2008; By60 Suunnitteluohje EC2 osat 1-1 ja 1-2, 2008; EN 1992-1-1, EN 1992-1-2 (ja muut EN-standardit tarvittavilta osin); BY51 Betonirakenteiden käyttöikäsuunnittelu 2007; BY47 Betonirakentamisen laatuohjeet 2007; RIL 229-2-2006 Rakennesuunnittelun asiakirjaohje, Mallipiirustukset ja -laskelmat; By47 Betonirakentamisen laatuohjeet 2007; RIL202-2012 Betonirakenteiden suunnitteluohje. Martin, Purkiss: Concrete design to EN 1992, Elsevier, 2nd ed. 2006. Lecture and exercise materials.

Assessment methods and criteria:

Continuous assessment. The course can be completed by participating in intermediate exams during the course, or in final exam. Assessment criteria are based on the learning outcomes of the course.

Grading:

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

Person responsible:

university teacher Raimo Hannila, LSc (tech.)

466109S: Concrete technology, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jorma Hopia

Opintokohteen kielet: Finnish

Leikkaavuudet:

485105A Concrete technology 5.0 op
460155S-01 Concrete Technology, examination 0.0 op
460155S-02 Concrete Technology, laboratory exercise 0.0 op
460155S Concrete Technology 4.5 op

ECTS Credits:

5 ECTS credits / 132 hours of work

Language of instruction:

Finnish

Timing:

Spring semester, periods 3-4

Learning outcomes:

After completing the course the student is able to specify concrete and the materials from which it is made. They can design normal concrete mixes and identify, describe and carry out the main laboratory tests relevant to the use of concrete on site.

Contents:

Cements and cementitious materials, aggregates for concrete, concrete mix design, properties of fresh and hardened concrete, laboratory tests, specification testing and compliance, environmental exposure classes.

Mode of delivery:

Face-to-face and distance learning

Learning activities and teaching methods:

Lectures, excercises, case studies, laboratory sessions and self directed learning

Target group:

Students studying structural engineering

Prerequisites and co-requisites:

466101A Introduction to building construction

Recommended optional programme components:

466101A Introduction to building construction

Recommended or required reading:

The material that is in English will be distributed at the lectures. Lecture notes (mainly in Finnish), 1) Luennoilla jaettu materiaali 2) Järvinen, Maarit. 2004. Betonitekniikan oppikirja : BY 201. Helsinki : Suomen Betonitieto.; 3) Suomen betoniyhdistys. Betoninormit 2004: BY 50. Helsinki : Suomen betonitieto; 4) Suomen Standardisoimisliitto ry. SFS-Standardisointi: 5) SFS-EN Standards

Assessment methods and criteria:

Passed laboratory excercises and exam

Grading:

Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:

Raimo Hannila

461107A: Finite Element Methods I, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Lumijärvi, Jouko Veikko Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

461033A	Finite Element Methods I	3.5 op
461033A-01	Finite Element Methods I, examination	0.0 op
461033A-02	Finite Element Methods I, exercises	0.0 op

ECTS Credits:

5 ECTS credits / 132 hours of work

Language of instruction:

Finnish

Timing:

Lectures and exercises, periods 1. - 2.

Learning outcomes:

The aim of this course is for students to gain an understanding of the basic idea and restrictions of FEM. After this course, the student can explain the basic idea of the FEM. He/she can analyze simple truss-, frame- and plane structures and explain the theoretical background of the calculations.

Contents:

The basic idea of FEM and its use in static analyses of bars, beams and plane structures. Some general principles of the use of FEM.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures and exercises take place during periods 1.-2. The course can be passed either by completing two midterm exams or a final exam.

Prerequisites and co-requisites:

Strength of Materials I and II.

Recommended or required reading:

Lecture notes (in Finnish), N. Ottosen & H. Petersson: Introduction to the Finite Element Method, NAFEMS: A Finite Element Primer, O. C. Zienkiewcz & R. L. Taylor: The Finite Element Method, 4th ed, Vol. 1: Basic Formulation and Linear Problems.

Assessment methods and criteria:

The grade of the course is based on midterm exams or a final exam. The student must pass the exercises before taking the examination.

Grading:

Numerical grading scale 1-5.

Person responsible:

Jouko Lumijärvi

461106A: Dynamics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Koivurova Hannu

Opintokohteen kielet: Finnish

Leikkaavuudet:

461018A-01 Dynamics, examination 0.0 op

461018A-02 Dynamics, exercises 0.0 op

461018A Dynamics 4.0 op

ECTS Credits:

5 ECTS credits / 120 hours of work

Language of instruction:

Finnish

Timing:

The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 2st spring semester.

Learning outcomes:

The aim of this course is to provide students with the ability to examine the relationship between the forces on a solid body and the resulting motion, position, speed and acceleration of the body. Learning outcomes: Upon completing the required coursework, the student knows and is able to explain the fundamental quantities and the base laws of the classical mechanics. He/she is able to choose an appropriate coordinate system and analyze the motion - position, velocity, and acceleration - of the parts of a device. The student is able to draw a free body diagram of a moving system, and compose and derive the equations of motion for a system using the direct momentum method, the work-energy method, and the impulse-momentum method.

Contents:

Introduction; Kinematics of a particle; Plane kinematics of a rigid body; Kinetics of a particl;. Basics of mechanical vibrations; Kinetics of a system of particles; Plane kinetics of a rigid body.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 45 h / Exercise 30 h / Self-study 45 h.

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:

Salmi, T. (2003) Dynamiikka 1, kinematiikka, Pressus; Salmi, T. (2002) Dynamiikka 2, kinetiikka, 2. p., Pressus. Oheiskirjallisuus: Salonen, E.M. (2000) Dynamiikka I, 8. korj. p., Otatieto; Salonen, E.M. (1999) Dynamiikka II, 8. korj. p., Otatieto; Beer, F., Johnston, E.(2007) Vector Mechanics for Dynamics, 9.ed., McGraw-Hill

Assessment methods and criteria:

This course utilizes continuous assessment. During the course, there are three intermediate exams. In addition to this, the students will be asked to calculate homeworks, and theses homeworks will be assessed. The assessment of the course is based on the learning outcomes of the course. The more detailed assessment criteria are available on the Optima Study Portal.

Grading:

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

Person responsible:

University Lecturer Hannu Koivurova

466102A: Introduction to structural design, 3 - 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Liedes, Hannu Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

485102A Introduction to structural design 5.0 op

460117A-01 Introduction to Structural Design, examination 0.0 op

460117A-02 Introduction to Structural Design, exercise work 0.0 op

460117A Introduction to Structural Design 6.0 op

ECTS Credits:

5 ECTS credits / 132 hours of work

Language of instruction:

Finnish

Timing:

Autumn semester, periods 1-2

Learning outcomes:

After completing the course the student is able to name technical regulations and instructions, which guide construction. After completing the course students can explicate principle of verifications and plastic theory on structure design and also different loads on structure. Student estimate design loads by calculation and design load effect in structures. Student can describe different structure and bracing systems.

Contents:

Regulations and supervising. The principle of design verification. The loads and effect. The principle of using of eurocode. The principle of plastic theory on on structure design. Structure systems. The joints of structures.

Mode of delivery:

Lecture room teaching.

Learning activities and teaching methods:

Lectures and exercises

Target group:

Students studying structural engineering

Prerequisites and co-requisites:

461016A Statics and 460101A Strength of Materials I

Recommended or required reading:

Lecture notes (mainly in Finnish), Finnish law and legislation, National building code of Finland, Eurocode standards

Assessment methods and criteria:

Passed practical works and exam

Grading:

Numerical grading scale 1-5. Grade 0 stands for a fail.

Person responsible:

University teacher Hannu Liedes

485021A: Construction Contracting, 5 op

Voimassaolo: 01.08.2018 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Civil Engineering field

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

488119A	Basics of infrastructure planning and development	5.0 op
466113S	Construction economics	5.0 op
460165A-02	Introduction to Construction Economics I, practical work	0.0 op
460165A-01	Introduction to Construction Economics I, examination	0.0 op

Other information:

This Course replaces courses 466113S and 488119A.

488980S: Master's Thesis in Environmental Engineering, 30 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Advanced Studies

Laji: Diploma thesis

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
30 ECTS
Language of instruction:
Finnish/English
Timing:
Recommended timing the spring term of the 2nd year of the master level.
Learning outcomes:
Upon completion of the thesis the student recognizes practical problems, she/he be able to create a research plan and research questions. She/He is able to plan the project and manage her/his own work according to the timetable. Student controlls different kind of research methods and be able to apply skills learned during master's studies to solving asked research questions. She/he understand practical meanings of solutions, limited and know if there is some useful outputs. The student can also utilize different information sources and critically evaluate the information obtained. The student is able to produce clear and finalized text, in line with technical and scientific writing practices.
Contents:
The student defines the contents of his / her work, consulting the supervisor of the Master's thesis. The Chief of degree programme accepts the contents, the subject and the topic of the thesis work.
Mode of delivery:
Individual work. The diploma thesis completes the master's degree studies.
Learning activities and teaching methods:
The Master's thesis work is supervised by a staff member of the Faculty and doing with industrial company.
Target group:
Environmental Engineering Master's students
Prerequisites and co-requisites:
Master's level studies of Degree programme.
Assessment methods and criteria:
The thesis work is made independently by the student as planned. The thesis work is saved digitally and reviewed through the University of Oulu Laturi electronic thesis (E-thesis) submission system. Final written report will evaluate.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Thesis' supervisor
Working life cooperation:
Working in or with the industrial company.

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.

A433123: Basic Studies, Process and Environmental Engineering, 70 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compolsory

477013P: Introduction to Process and Environmental Engineering, 5 op

Voimassaolo: 01.12.2016 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

ECTS Credits:

5 cr / 135 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 1st autumn semester.

Learning outcomes:

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

Contents:

1. Unit operations. 2. Material balances. 3. Phenomenon-based considerations. 4. Material transport. 5. Process control and automation. 6. Principles in use, planning and protection of water and land resources: primary production, municipalities and industry. 7. Energy systems. 8. Productive activity as a part of society.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Pair exercises and contact-education that supports these exercises. The amount of classroom education is 16-32 hours the rest being studying independently. Only in Finnish.

Target group:

Students of process and environmental engineering

Prerequisites and co-requisites:

No prerequisities.

Recommended optional programme components:

This course is an introduction to the other courses of process and environmental engineering. Additionally, this course has connections to the course of Technical communication (900060A). It is recommended to complete these courses simultaneously if possible.

Recommended or required reading:

Material will be distributed during lectures and via courses www-site. Students are required to acquire additional material for the exercises.

Assessment methods and criteria:

This course utilizes continuous assessment. During the course, there are eight exercises that are made as pair-work. Please note that the course is not organised in English.

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:

There is no direct working life cooperation in this course.

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.

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:

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 e-lectures.

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

Grading:

Verbal scale Passed/Failed

Person responsible:

Education designer Saara Luhtaanmäki

Working life cooperation:

Older students tell their working life experience.

Other information:

-

031010P: Calculus I, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Ilkka Lusikka

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay031010P	Calculus I (OPEN UNI)	5.0 op

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

Finnish. The course can be completed in English by intermediate exams or by a final exam.

Timing:

Autumn semester, period 1

Learning outcomes:

Upon completion of the course, the student identifies concepts of vector algebra, can use vector algebra for solving problems of analytic geometry, can explain basic characteristics of elementary functions, is able to analyse the limit and the continuity of real valued functions of one variable, 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 28 h / Group work 22 h / Self-study 85 h.

Target group:

-

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Grossman, S.I.: Calculus of One Variable; Grossman, 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:

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

Person responsible:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

031075P: Calculus II, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

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 ECTS credits / 135 hours of work

Language of instruction:

Finnish. The course can be completed in English by intermediate exams or by a final exam.

Timing:

Spring semester, period 3

Learning outcomes:

Upon completion of the course, the student is able to examine the convergence of series and power series of real terms, can explain the use of power series e.g. in calculating limits, 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 22 h / Self-study 85 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the course 031010P Calculus I.

Recommended optional programme components:

-

Recommended or required reading:

Kreyszig, E: Advanced Engineering Mathematics; Grossman S.I.: Multivariable Calculus, Linear Algebra, and Differential Equations; Adams, R.A.: A Complete Course Calculus.

Assessment methods and criteria:

Intermediate exams or a final exam.
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:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

031076P: Differential Equations, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Ruotsalainen Keijo

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

Finnish

Timing:

The course is held in the spring, during period 4. It is recommended to complete the course at the 1th spring semester.

Learning outcomes:

The students can apply differential equations as a mathematical model. They can identify and solve various differential equations and they have knowledge on basic solvability of differential equations. The student can use the Laplace transform as a solution method.

Contents:

Ordinary differential equations of first and higher order.
Laplace transform with applications to differential equations.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h / Group work 22 h / Self-study 85 h.

Target group:

1. year students of technical sciences, mathematics and physics.

Prerequisites and co-requisites:

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

Recommended optional programme components:

-

Recommended or required reading:

Recommented literature: Kreyszig, E: Advanced Engineering Mathematics;

Assessment methods and criteria:

The course can be completed by intermediate exams (2 exams) or by a final exam.
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:

Keijo Ruotsalainen

Working life cooperation:

-

Other information:

-

031078P: Matrix Algebra, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

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

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

Finnish

Timing:

The course is held in the autumn, during period 2. It is recommended to complete the course at the 1th autumn semester.

Learning outcomes:

The student is able to apply arithmetic operations of matrices and can solve system of linear equations by matrix methods and can apply matrix factorizations to find the solution of the system of linear equations. The student is able to recognize the vector space and understands the concepts of basis and dimension of a vector space and can analyse matrices by the parameters, vectors and vector spaces of matrices. He /She knows how to calculate determinant, eigenvalues and eigenvectors of a square matrix, and is able to diagonalize matrices and apply diagonalization to the simple problems.

Contents:

1. Vectors and matrices 2. Systems of linear equations. 3. Matrix factorizations. 4. Vector spaces. 5. The rank, nullity, row space and the column space of a matrix. 6. The determinant of a matrix. 7. Eigenvalues and eigenvectors of a matrix. 8. The diagonalization with applications.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h / Group work 22 h / Self-study 85 h.

Target group:

1. year students of technical sciences, mathematics and physics.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Recommented literature: Grossman, S.I: Elementary Linear Algebra; David C. Lay: Linear Algebra and Its Applications.

Assessment methods and criteria:

The course can be completed by intermediate exams (2 exams) or by a final exam.
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:

Matti Peltola

Working life cooperation:

-

Other information:

-

031021P: Probability and Mathematical Statistics, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

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 ECTS credits / 135 hours of work

Language of instruction:

Finnish

Timing:

Spring semester, period 3

Learning outcomes:

After completing the course the student

1. knows the key concepts of probability and the most important random variables,
2. will be able to use them in calculating probabilities and parameters of probability distributions,
3. is capable of analyzing statistical data by calculating interval and point estimates for the parameters,
4. will be able to formulate statistical hypotheses and test them,
5. knows the basics of linear regression.

Contents:

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

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h/Exercises 20 h/Self study 87 h.

Target group:

The students in the engineering sciences. Other students are welcome, too.

Prerequisites and co-requisites:

The recommended prerequisities are the course 031010P Calculus I and some parts of the course 031075P Calculus II.

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:

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:

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

Person responsible:

Jukka Kemppainen

Working life cooperation:

-

Other information:

-

761118P: Mechanics 1, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Physics

Arvostelu: 1 - 5, pass, fail

Opettajat: Vaara, Juha Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

766343A	Mechanics	7.0 op
761111P	Basic mechanics	5.0 op
761101P	Basic Mechanics	4.0 op
766323A	Mechanics	6.0 op
761323A	Mechanics	6.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work
- 761118P-01, Lectures and exam (4 cr)
- 761118P-02, Lab. exercises (1 cr)

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 30 h, 7 exercises (14 h), 2 laboratory exercises (3 hours/exercise), self-study 83 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.

Assessment methods and criteria:

Both parts (761118P-01 and 761118P-02) will be graded separately. The final grade of the course is the weighted average of the grades of part 1 (4 cr) and part 2 (1 cr).
761118P-01: Three midterm exams or final examination
761118P-02: Two laboratory exercises
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Juha Vaara

Working life cooperation:

No work placement period

Other information:

https://wiki.oulu.fi/display/761118P

Compulsory

761118P-01: Mechanics 1, lectures and exam, 0 op

Voimassaolo: 01.01.2017 -

Opiskelumuoto: Basic Studies

Laji: Partial credit

Vastuuyksikkö: Field of Physics

Arvostelu: 1 - 5, pass, fail

Opettajat: Vaara, Juha Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

766343A	Mechanics	7.0 op
761111P-02	Basic mechanics, lab. exercises	0.0 op
761111P-01	Basic mechanics, lectures and exam	0.0 op
761111P	Basic mechanics	5.0 op
761121P	Physical Measurements I	3.0 op
761101P	Basic Mechanics	4.0 op
761323A	Mechanics	6.0 op
766323A	Mechanics	6.0 op

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:

The whole course: Lectures 30 h, 7 exercises (14 h), 2 laboratory exercises (3 hours/exercise), self-study 83 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.

Assessment methods and criteria:

761118P-01: Three midterm exams or final examination

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Juha Vaara

Working life cooperation:

No work placement period

Other information:

Course website
Both parts (761118P-01 and 761118P-02) will be graded separately. The final grade of the course is the weighted average of the grades of part 1 (4 cr) and part 2 (1 cr).

761118P-02: Mechanics 1, lab. exercises, 0 op

Voimassaolo: 01.01.2017 -

Opiskelumuoto: Basic Studies

Laji: Partial credit

Vastuuyksikkö: Field of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

766343A	Mechanics	7.0 op
761111P-01	Basic mechanics, lectures and exam	0.0 op

761111P-02	Basic mechanics, lab. exercises	0.0 op
761111P	Basic mechanics	5.0 op
761101P	Basic Mechanics	4.0 op
761323A	Mechanics	6.0 op
766323A	Mechanics	6.0 op

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:

The whole course: Lectures 30 h, 7 exercises (14 h), 2 laboratory exercises (3 hours/exercise), self-study 83 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.

Other information:

Course website

761119P: Electromagnetism 1, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Physics

Arvostelu: 1 - 5, pass, fail

Opettajat: Timo Asikainen

Opintokohteen kielet: Finnish

Leikkaavuudet:

761113P-01	Electricity and magnetism, lectures and exam	0.0 op
761113P-02	Electricity and magnetism, lab. exercises	0.0 op
761113P	Electricity and magnetism	5.0 op
766319A	Electromagnetism	7.0 op
761103P	Electricity and Magnetism	4.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work
- 761119P-01, Lectures and exam (4 cr)
- 761119P-02, Lab. exercises (1 cr)

Language of instruction:

Finnish

Timing:

Second fall term

Learning outcomes:

The student will be able to understand the basic concepts of electromagnetism and can apply this understanding to solve problems related to electromagnetism.

Contents:

Basic principles of electromagnetic phenomena and their physical and geometric interpretation. More detailed contents will be presented later.

Mode of delivery:

face-to-face teaching

Learning activities and teaching methods:

Lectures 32 h, 7 exercises (14 h), 2 laboratory exercises (3 hours/exercise), self-study 83 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, 13. ed., chapters 21-31. Also other editions can be used. Lecture material in finnish.

Assessment methods and criteria:

Both parts (761119P-01 and 761119P-02) will be graded separately. The final grade of the course is the weighted average of the grades of part 1 (4 cr) and part 2 (1 cr).
761119P-01: Three small midterm exams or final examination
761119P-02: Two laboratory exercises
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Timo Asikainen

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
780103P2	Organic Chemistry I	6.0 op
780108P	Basic Course in Organic Chemistry	6.0 op
780112P	Introduction to Organic Chemistry	4.0 op
780103P	Introduction to Organic Chemistry	6.0 op

ECTS Credits:

5 credits / 134 hours of work

Language of instruction:

Finnish. Book-examination in English as well.

Timing:

1st spring

Learning outcomes:

After this course, the student:
- can recognize and name basic organic compunds and explain their properties.
- can explain organic chemistry basic consepts.
- can deduce basic recation types and solve their mechanisms.

Contents:

Classification of organic compounds and their properties. Basic reactions of organic compounds: addition, elimination and substitution along with the reaction mechanisms. Basics of stereochemistry.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

38 hours of lectures plus 12 hours of exercises, 84 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:

Johanna Kärkkäinen

Working life cooperation:

No

Other information:

No

780120P: Basic Principles in Chemistry, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Chemistry

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

780117P	General and Inorganic Chemistry A	5.0 op
780109P	Basic Principles in Chemistry	4.0 op

ECTS Credits:

5 credits/134 hours of work

Language of instruction:

Finnish

Timing:

1st autumn

Learning outcomes:

Upon completion of the course, the student will be able to display an understanding of basic chemistry phenomenon; equilibrium of acids and bases, chemical equilibrium, redox reactions and stoichiometry.

Contents:

Introduction to chemistry, stoichiometry, redox reactions, chemical equilibrium, the equilibrium of acid and bases, buffer solutions, titration, thermodynamics.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

40 hours of lectures and 94 hours of self-study

Target group:

Biology, Geology, Process Engineering, Environmental Engineering compulsory. Geography, optional.

Prerequisites and co-requisites:

The compulsory course in upper secondary school chemistry (1st course)

Recommended optional programme components:

The course is not included in the 25 ECTS credits entity of chemistry!

Recommended or required reading:

Tro, N.J., Principles of Chemistry. A Molecular Approach, Pearson, 3. edition, 2016

Assessment methods and criteria:

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 Minna Tiainen

Working life cooperation:

No

Other information:

No

030005P: Information Skills, 1 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Faculty of Technology

Arvostelu: 1 - 5, pass, fail

Opettajat: Ursula Heinikoski

Opintokohteen kielet: Finnish

Leikkaavuudet:

030004P	Introduction to Information Retrieval	0.0 op

ECTS Credits:

1 ECTS credits / 27 hours of work

Language of instruction:

Finnish

Timing:

Architecture 3. spring semester, period I; Biochemistry 3. autumn semester; Biology 3. autumn semester, period I; Chemistry 3. autumn semester, period II; Computer Science and Engineering 2. spring semester, period IV; Electronics and Communications Engineering 3. spring semester; Geosciences 2. spring semester, period IV; Geography 1. and 3. spring semester, period III; Industrial Engineering and Management 3. year (Master's degree students in Industrial Engineering and Management 1st year.); Information Processing Sciences 1. year; Mathematics and Physics 1. spring semester, period III; Mechanical Engineering 3. year; Mining Engineering and Mineral Processing 3. year; Process and Environmental Engineering 2. year, period II.

Learning outcomes:

Upon completion of the course, the students:
- can search scientific information,
- can use the most important databases of their discipline,
- know how to evaluate search results and information sources,
- can use the reference management tool

Contents:

Scientific information retrieval process, the most important databases and publication channels of the discipline, evaluation of the reliability of information sources and RefWorks reference management tool.

Mode of delivery:

Blended teaching: classroom training, web-based learning material and exercises, a group assignment.

Learning activities and teaching methods:

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

Target group:

Compulsory for all bachelor degree students of Faculty of Information Technology and Electrical Engineering, Faculty of Technology and Faculty of Science. Compulsory also for those Master's degree students in Industrial Engineering and Management who have no earlier studies in the information skills. Optional for the students of biochemistry.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Web learning material Tieteellisen tiedonhankinnan opas http://libguides.oulu.fi/tieteellinentiedonhankinta (in Finnish)

Assessment methods and criteria:

Passing the course requires participation in the training sessions and successful completion of the course assignments.

Grading:

pass/fail

Person responsible:

Ursula Heinikoski

Working life cooperation:

-

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

Opettajat: Pekka Rossi

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:

-

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

Leikkaavuudet:

780127P	Principles of Chemistry Labwork	5.0 op

ECTS Credits:

5 credits / 135 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, 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, 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, 40 hours of laboratory works, 93 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:

Basic Principles in Chemistry (780120P or 780109P) or General and Inorganic Chemistry A (780117P).
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 (780117P, 5 cr) and Introduction to Organic Chemistry (780116P, 5 cr).

Recommended or required reading:

Instruction Book (in Finnish): Kemian perustyöt 780123P.

Assessment methods and criteria:

Accomplishment of the course requires accepted preparatory problems, laboratory exercises and problems related to them.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes verbal grading scale pass/fail.

Person responsible:

Teija Kangas

Working life cooperation:

No

Other information:

Attendance at the lecture of Safety at work is compulsory.

Choose Languages, 6 ECTS English or German

902150Y: Professional English for Technology, 2 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

902011P-05	TE3/ Professional English for Technology	2.0 op

Proficiency level:

CEFR B2 - C1

Status:

This course is the first English course for students in the engineering programmes in the Faculty of Technology (TTK) and Faculty of Information Technology and Electrical Engineering (TST).

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:

2 credits. The workload is 53 hours.

Language of instruction:

English

Timing:

The course takes place in the autumn semester (periods 1 and 2).

Learning outcomes:

By the end of the course, you can

- create and deliver effective presentations of a product, a company and company processes,
- apply appropriate cultural, linguistic and technical knowledge when presenting a product or company,
- formulate strategies for developing your English-language communication skills based on an evaluation of your own strengths and weaknesses.

Contents:

Scheduled as the first course of your English studies, Professional English for Technology (PET) has a strong focus on developing speaking skills necessary for working life. During PET, you will explore a product or service from your fown field, and give a variety of short presentations in connection with your product or service. In addition, PET helps you to develop an awareness of your own language skills, encouraging you to develop strategies and techniques for effective learning.

Mode of delivery:

Contact teaching and independent study

Learning activities and teaching methods:

Lessons 24 hours / team work 22 hours / independent work 7 hours. Lessons include regular pair and group work in class. Team work includes the preparation of four short presentations (22 hours). Independent homework activities include an online vocabulary test (3 hours) and other small assignments (5 hours). Active participation is essential.

Target group:

Students in the engineering programmes: TTK (PO1, YMP1, KO1, TuTa1, KaiRik1), TST (ST2, CSE2).

Prerequisites and co-requisites:

-

Recommended optional programme components:

This course is offered as the first course of your English studies.

Recommended or required reading:

Course materials will be provided by the teacher in electronic form.

Assessment methods and criteria:

The course utilises continuous assessment that is based on the learning outcomes of the course, including full and active participation in class, and the successful completion of module assignments and class presentations. Students must achieve a grade of 75% in the online vocabulary test.
Lue lisää opintosuoritusten arvostelusta yliopiston verkkosivulta.

Grading:

pass / fail

Person responsible:

Each engineering programme has its own Languages and Communication contact teacher for questions about English studies.

Working life cooperation:

-

Other information:

-

902142Y: Business Correspondence, 2 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Proficiency level:

CEFR B2 - C1 (All Levels)

Status:

This course can be chosen in partial completion of the English language requirement for students in the engineering programmes in the Faculty of Technology (TTK) and Faculty of Information Technology and Electrical Engineering (TST).

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:

2 credits. The workload is 53 hours

Language of instruction:

English

Timing:

The course takes place in both autumn (periods 1 and 2) and spring (periods 3 and 4) semesters.

Learning outcomes:

By the end of the course, you are expected to have demonstrated:

- the ability to write clear and effective business letters conveying information and details accurately,
- the ability to use an appropriate level of formality and style for business communications,
- mastery of the conventional formats and layouts of different types of business letters.

Contents:

The aim of this course is to introduce different types of business correspondence and the format used when communicating in writing. Types of correspondence include communication in business-to-business scenarios and between a business and the public.

Mode of delivery:

Self-access: the course operates within an Optima workspace, with online support from the teacher.

Learning activities and teaching methods:

Introductory session 2 hours / independent learning 51 hrs / optional text clinics. Assignments, instructions and course resources are available in the course Optima workspace. Completed assignments are submitted electronically to the teacher. The teacher provides feedback and any problems are discussed either by written electronic communication or at one of the optional text clinics.

Target group:

Students in the engineering programmes (TTK and TST)

Prerequisites and co-requisites:

-

Recommended optional programme components:

This is an elective course which can be taken after 902150Y PET by students in the engineering programmes (TTK, TST and OMS).

Recommended or required reading:

Course materials are provided in an electronic form that can be downloaded.

Assessment methods and criteria:

All assignments must be completed to a standard of effective business correspondence based on the learning outcomes of the course. In addition, there is a test at the end of the course.
Lue lisää opintosuoritusten arvostelusta yliopiston verkkosivulta.

Grading:

Pass/Fail

Person responsible:

See contact teachers

Working life cooperation:

-

Other information:

-

902145Y: Working Life Skills, 2 op

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Proficiency level:

CEFR B2 - C1 (All Levels)

Status:

This course can be chosen in partial completion of the English language requirement for students in the engineering programmes in the Faculty of Technology (TTK) and Faculty of Information Technology and Electrical Engineering (TST).

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:

2 ECTS credits. The workload is 53 hours.

Language of instruction:

English

Timing:

The course takes place in both autumn (periods 1 and 2) and spring (periods 3 and 4) semesters.

Learning outcomes:

By the end of the course, you are expected to

1. have demonstrated a good basic vocabulary related to job applications, meetings and negotiations,
2. have demonstrated an ability to create an effective CV and cover letter for a job application,
3. be able to communicate effectively and with a reasonable degree of fluency at job interviews and in meeting and negotiation contexts.

Contents:

The aim of this course is to help you to develop the English language skills needed to deal with situations related to everyday working life. The course focuses on 4 basic areas:
i) business communication (e.g. telephoning skills and correspondence),
ii) social English in working life situations,
iii) applying for a job,
iv) a general introduction to the language of meetings and negotiations.

Mode of delivery:

Contact teaching and independent study

Learning activities and teaching methods:

Lessons 26 hours / independent work 27 hours. Active participation is essential. The course includes regular pair and group work in class and independent homework activities.

Target group:

Students in the engineering programmes (TTK and TST).

Prerequisites and co-requisites:

-

Recommended optional programme components:

This is an elective course which can be taken after 902150Y PET by students in the engineering programmes (TTK and TST).

Recommended or required reading:

Course materials will be provided by the teacher in electronic form.

Assessment methods and criteria:

The course utilises continuous assessment that is based on the learning outcomes of the course. In addition, full and active participation is required, course assignments must be completed, and students must achieve a grade of 70% in two tests during the course. Students will be asked to take an end-of course exam if they have not otherwise demonstrated that they have achieved the learning outcomes by the end of the course.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Pass/Fail

Person responsible:

See contact teachers

Working life cooperation:

-

Other information:

-

902146Y: Presentation Skills, 2 op

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Ei opintojaksokuvauksia.

902147Y: Academic Vocabulary for Science and Technology, 2 op

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Proficiency level:

CEFR Level: B2-C1 (All levels)

Status:

This course can be chosen in partial completion of the English language requirement for students in the engineering programmes in the Faculty of Technology (TTK) and Faculty of Information Technology and Electrical Engineering (TST).

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:

2 ECTS credits. The workload is 53 hours.

Language of instruction:

English

Timing:

The course takes place in both autumn (periods 1 and 2) and spring (periods 3 and 4) semesters.

Learning outcomes:

By the end of the course, you are expected to be able to
1) define what you need to know about a word or a lexical phrase in order to learn vocabulary,
2) give examples of how words are built from meaningful parts,
3) apply vocabulary learning techniques,
4) explain and apply general academic / scientific vocabulary (AWL),
5) outline the characteristics of informal vs. formal / academic vocabulary,
6) demonstrate basic academic writing and communication skills.

Contents:

The general aim of this module is 1) to help you become aware of the strategies which best promote your skills to learn and memorise vocabulary, and 2) to activate and broaden your basic scientific vocabulary, i.e. the core vocabulary of scientific texts, which is principally the same regardless of the field (*the Academic Word List*).
The ultimate aim is to help you gain the skills to read and write academic / scientific text and to discuss related topics.
To help you achieve the learning outcomes, you will be given many varied written and oral activities which focus primarily on practicing vocabulary learning strategies, word formation, and the use of the most frequent academic vocabulary (AWL sublists).

Mode of delivery:

Contact teaching and independent study

Learning activities and teaching methods:

Lessons 26 hours / independent work 27 hours. The independent work includes an essay (6 hours); two exams (10), one around the midpoint of the course and the other towards the end; presentations (6), which will be given in class to small groups of students; and other homework assignments (5 hours). Active participation is essential.

Target group:

Students in the engineering programmes (TTK and TST)

Prerequisites and co-requisites:

-

Recommended optional programme components:

This is an elective course which can be taken after 902150Y PET by students in the engineering programmes (TTK and TST).

Recommended or required reading:

Course materials will be provided by the teacher in electronic form.

Assessment methods and criteria:

Regular and active participation in the weekly sessions will be observed in continuous assessment that is based on the learning outcomes of the course. In addition to this, satisfactory completion of the in-class/ homework assignments and the two vocabulary tests is required.
Lue lisää opintosuoritusten arvostelusta yliopiston verkkosivulta.

Grading:

Pass/Fail

Person responsible:

See contact teachers

Working life cooperation:

-

Other information:

-

902149Y: Mechanics of Writing, 2 op

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Proficiency level:

CEFR B2-C1 (Average - Advanced)

Status:

This course can be chosen in partial completion of the English language requirement for students in the engineering programmes in the Faculty of Technology (TTK) and Faculty of Information Technology and Electrical Engineering (TST).

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:

2 credits. The workload is 53 hours.

Language of instruction:

English

Timing:

The course takes place in both autumn (periods 1 and 2) and spring (periods 3 and 4) semesters.

Learning outcomes:

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

1. you can organise the structure of sentences and paragraphs for clarity and impact,
2. you can use punctuation appropriately,
3. you can make appropriate stylistic choices in academic writing.

Contents:

The purpose of this course is to help you develop essential writing skills for the production of academic and professional texts in technology.
The module covers three main topics: ordering information in sentences, punctuation and sentence style. During the module, students work independently, studying online handouts and consolidating their learning by working through online exercises.

Mode of delivery:

Web-supported independent study

Learning activities and teaching methods:

This module is completed through independent study of online resources (online handouts and exercises). An online tutor is available to answer questions and give guidance whenever necessary.

Target group:

Students in the engineering programmes (TTK and TST). Especially recommended for students with M or higher for English in matriculation exam.

Prerequisites and co-requisites:

-

Recommended optional programme components:

This is an elective course which can be taken after 902150Y PET by students in the engineering programmes (TTK and TST).

Recommended or required reading:

Course materials are available online.

Assessment methods and criteria:

The module is assessed by a final test, which can be taken on any of three test dates (approximately a month apart) in a classroom on the Linnanmaa campus.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Pass/Fail

Person responsible:

See contact teachers

Working life cooperation:

-

Other information:

-

903030Y: Intermediate Course in German 2, 3 - 4 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: German

Proficiency level:

CEFR scale A2/B1

Status:

The course is optional and it may be included in your faculty's Language, Cultural and Communication Studies (KieKuVi) or in Other Studies. It may also be included as a partial 3 credit course in the Technical German 1 or 3.

Required proficiency level:

3 years of German studies during secondary education or equivalent knowledge. 903024Y Elementary Course in German 1 & 903025Y Elementary Course in German 2.

ECTS Credits:

3 - 4 ECTS credits / 80 - 106 h of work for the student.

Language of instruction:

German

Timing:

The course is held in spring term. Please note: Intermediate Course in German 2 and Intermediate Course in German 1 can be studied in a way that first Course 2 can be taken in Spring term and after that Course 1 in Autumn term.

Learning outcomes:

The aim of the course is to develop the student's language skills in different areas: improve the student's oral and written capabilities, develop his/her listening comprehension and broaden his/her vocabulary. Upon completion of the course the student should be able to manage in everyday communication situations and express and justify his/her opinions. He/she should be able to understand texts about familiar topics written in standard language and produce coherent text on topics and themes interesting to him/her.

Contents:

Grammar exercises, reading and listening comprehension exercises and writing exercises relating to work and study-related situations, small talk, politeness and German-speaking countries.

Mode of delivery:

Contact teaching. More detailed information in the beginning of the course.

Learning activities and teaching methods:

Contact teaching 2 times 90 min. / week , independent study
80 h of work for 3 credits
106 h of work for 4 credits

Target group:

Students of all faculties and exchange students.

Prerequisites and co-requisites:

See Required proficiency level

Recommended or required reading:

Material prepared by the teacher.

Assessment methods and criteria:

Regular and active participation, homework assignments and tests. Continuous assesment.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Scale 1 - 5 or pass / fail

Person responsible:

Oliver Jarde

Working life cooperation:

-

Other information:

Registration in WebOodi. If the registration has closed the student can sign up by contacting the teacher by e-mail.

903042Y: Intermediate Course in German 3, 2 - 4 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: German

Proficiency level:

CEFR level B1

Status:

The course is optional. It can be approved as a partial completion of the course 903012P Technical German 3. This partial completion is worth 3 ECTS credits. It may also be included in your faculty's Language, Culture and Communication Studies (KieKuVi) or in other optional studies.

Required proficiency level:

7 years of German studies during secondary education or equivalent knowledge, for example 903030Y Intermediate German II.

ECTS Credits:

2 - 4 ECTS credits / 54 - 106 h of student's work.

Language of instruction:

German

Timing:

The course is held at Autumn semester (1 group).

Learning outcomes:

Upon completion of the course the student should be able to manage in typical professional and special-field specific communication situations in an interactive manner. He/she should be able to actively participate in discussions about current events and special field-specific topics, express his/her views on different matters and present the pros and cons of different options. The student should be experienced in giving short oral presentations about topics related to his/her special field. He/she should understand the culture-specific nature of Finnish and German customs and practices and be able to compare them with each other.

Contents:

The course covers themes relating to German-speaking countries and student and professional life with the help of various discussion exercises. The course also includes project work and self-study, which allow the student to immerse himself/herself into topics he/she is interested in.

Mode of delivery:

Contact teaching

Learning activities and teaching methods:

2 ECTS credits: 1 x 90 min./week or 2 x 90 min./week , 26 h in total and regular and active participation in teaching and completion of agreed upon exercises 28 h.
3 ECTS credits: 2 x 90 min./week, 48 h in total and regular and active participation in teaching and completion of agreed upon exercises 32 h.
4 ECTS credits: 2 x 90 min./week, 48 h in total and regular and active participation in teaching and completion of agreed upon exercises 32 h **and** self-study (reading comprehension exercises and project) 26 h.

Target group:

Students of all faculties and exchange students

Prerequisites and co-requisites:

See Required proficiency level.

Recommended optional programme components:

-

Recommended or required reading:

Material prepared by the teacher.

Assessment methods and criteria:

Completion of the course requires regular and active participation in teaching and completion of the project. Continuous assesment.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Scale 1 - 5 or pass / fail

Person responsible:

Oliver Jarde

Working life cooperation:

-

Other information:

Registration in WebOodi. If the registration has closed the student can sign up by contacting the teacher by e-mail.

903048Y: Intermediate Course in German IV, 2 - 4 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: German

Proficiency level:

CEFR levels B1/B2

Status:

The course is optional and it may be included in your faculty's Language, Cultural and Communication Studies (KieKuVi) or in other optional studies.

Required proficiency level:

7 years of German studies during secondary education or equivalent knowledge, for example 903042Y Intermediate course in German III.

ECTS Credits:

2 - 4 ECTS credits / 54 - 106 h of student's work.

Language of instruction:

German

Timing:

The course is held at Spring semester.

Learning outcomes:

The student should be able to actively participate in discussions about familiar topics and explain his/her views on the different matters as well as discuss the pros and cons of different options. He/she should understand the culture-specific nature of Finnish and German customs and practices and be able to compare them with each other.

Contents:

The course covers themes relating to German-speaking countries and professional and student life with the help of various discussion exercises and text and video material. The course also includes project work and self-study, which allow the student to immerse himself/herself into topics he/she is interested in. The course also focuses on intercultural communication and current events and phenomena in German-speaking countries.

Mode of delivery:

Contact teaching and self-study. More detailed information in the beginning of the course.

Learning activities and teaching methods:

Cntact-teaching 2 x 90 min/week, self-study, together 106 h / course. Number of contact teaching can vary depending on the credits needed.

Target group:

Students of all faculties and exchange students

Prerequisites and co-requisites:

See Required proficiency level

Recommended optional programme components:

-

Recommended or required reading:

Material prepared by the teacher.

Assessment methods and criteria:

Completion of the course requires regular and active participation in teaching and completion of the project.
Continuous assesment.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Scale 1 - 5 or pass / fail

Person responsible:

Oliver Jarde

Working life cooperation:

-

Other information:

Registration in WebOodi. If the registration has closed the student can sign up by contacting the teacher by e-mail.

Choose the Second Language

901044Y: Second Official Language (Swedish), Written Skills, 1 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Opintokohteen kielet: Swedish

Leikkaavuudet:

901060Y	Second Official Language (Swedish), Written Skills	1.0 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.
This course includes also 901045Y Second Official Language (Swedish) Oral Skills, 1 ECTS credits.

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:

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

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. Sign up only to a course 901044Y Second Official Language (Swedish) Written Skills, 1 ECTS credits.
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.

901045Y: Second Official Language (Swedish), Oral Skills, 1 op

Voimassaolo: 01.08.2014 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuyksikkö: Languages and Communication
Opintokohteen kielet: Swedish
Leikkaavuudet:

901061Y	Second Official Language (Swedish), Oral Skills	1.0 op

900081Y: Second Official Language (Finnish), Written Skills, 1 - 2 op

Voimassaolo: 01.01.2015 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuyksikkö: Languages and Communication
Opintokohteen kielet: Finnish

900082Y: Second Official Language (Finnish), Oral Skills, 1 - 3 op

Voimassaolo: 01.01.2015 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuyksikkö: Languages and Communication
Opintokohteen kielet: Finnish

A433125: Intermediate Studies, Process and Environmental Engineering, 60 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Intermediate Studies
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compolsory

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

Opettajat: Hiltunen, Jukka Antero

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 2

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:

-

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

Opettajat: Ainassaari, Kaisu Maritta

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.

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:

The course 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 Kaisu Ainassaari

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

Opettajat: Elisa Koivuranta

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 equipment 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 or with web learning.

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 three intermediate exams with potential web learning, lecture diary and/or homework. 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:

Elisa Koivuranta

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

Opettajat: Elisa Koivuranta

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 equipment and phenomena related to them. In addition, the student can explain application of unit processes and can describe their operational principles.

Contents:

Liquid and suspensions: 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 or with web learning.

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 three intermediate exams with potential web learning, lecture diary and/or homework. 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:

Elisa Koivuranta

Working life cooperation:

No

Other information:

-

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:

Spring periods 3 and 4.

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:

-

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:

Finnish

Timing:

The course is held in the autumn semester, during period I. It is recommended to complete the course at the 2nd autumn semester.

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 (26 hours), software exercises (4 hours) as well as other exercises. Only in Finnish.

Target group:

Students of process and environmental engineering

Prerequisites and co-requisites:

'Basic Principles in Chemistry' or corresponding knowledge is recommended as prerequisite.

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. It is also available via courses www-site.

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.

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:

There is no direct working life cooperation in this course.

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.

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

Opettajat: Ahola, Juha Lennart

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:

-

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

Opettajat: Ainassaari, Kaisu Maritta

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.

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:

The course 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 4 intermediate exams. The course can also be completed by final examination.

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

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 the 2nd period. 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:

-

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:

Aki Sorsa

Working life cooperation:

No

Other information:

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

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

ECTS Credits:

5 ECTS credits.

Language of instruction:

Finnish. English material is also used.

Timing:

Periods 1-2.

Learning outcomes:

Upon completion of the course, the student will be able to:

- describe what industrial engineering and management (or operations management) means
- explain the core concepts of business operations and utilise these concepts in describing and analysing operations of an organisation
- explain in general terms the factors that affect economic performance of organisations
- utilise the terminology used in industrial engineering and management (operations management), describe the financial processes of companies and based on this describe the use of cost accounting in organisational decision-making
- 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, accounting and cost accounting, investments and financial planning, 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. In addition, recommended materials include Martinsuo, M. et al. (2016) Teollisuustalous kehittyvässä liiketoiminnassa chapters 7-9, 16 and 26.

Assessment methods and criteria:

This course utilises 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:

Adjunct professor Jukka Majava

Working life cooperation:

-

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

ECTS Credits:

5 ECTS credits.

Language of instruction:

Finnish. English material is also used.

Timing:

Periods 3-4.

Learning outcomes:

Upon completion of the course, the student will be able to:

- explain the basic terms of occupational safety and health
- assess the importance of occupational safety, health and well-being at work
- assess the significance of occupational safety in the improving of productivity and quality
- apply different safety analysis
- explain 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:

Mertanen V. 2015. Työturvallisuuden perusteet. Helsinki: Työterveyslaitos. 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:

MSc Henri Jounila

Working life cooperation:

-

Other information:

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

A431127: Module Preparing for the Option: Process Engineering, 40 op

Voimassaolo: 01.08.2017 -

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.

Compolsory

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: Hiltunen, Jukka Antero

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.

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:

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 (36 hours) + self study. Only in Finnish.

Target group:

Students of process and environmental 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:

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:

There is no direct working life cooperation in this course.

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

Opettajat: Elisa Koivuranta, Petri Tervasmäki

Opintokohteen kielet: English

Leikkaavuudet:

488054A	Introduction to Bioproduct and Bioprocess engineering	5.0 op
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 /135 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:

This course utilizes continuous assessment including lecture exams with potential web learning. 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 unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Elisa Koivuranta, Petri Tervasmäki

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

Opettajat: Johanna Panula-Perälä

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 /135 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:

Johanna Panula-Perälä

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:

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-economic performance of the process based on holistic criteria.

Contents:

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

Dr Jani Kangas

Working life cooperation:

-

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

Opettajat: Hiltunen, Jukka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

477602A	Control System Analysis	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

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

Opettajat: Hiltunen, Jukka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

477603A	Control System Design	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

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:

-

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: Marko Paavola

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:

Marko Paavola

Working life cooperation:

No

Other information:

-

A432129: Module Preparing for the Option: Environmental Engineering/Energy and Environmental Engineering, 40 op

Voimassaolo: 01.08.2017 -

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.

Choose the Other

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: Hiltunen, Jukka Antero

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.

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

Opettajat: Väisänen, Virpi Maria

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 and environmental conservation. 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 environmental toxicology.

Contents:

Principles of environmental ecology. Global and regional environmental problems and their effects. Principles of environmental toxicology. Engineering and environmental ethics.

Mode of delivery:

e-learning

Learning activities and teaching methods:

Individual e-learning 133 h following the schedule of the course.

Target group:

Bachelor's degree students of environmental engineering. International exchange students.

Recommended optional programme components:

-

Recommended or required reading:

Chiras D.: Environmental Science. New York, Jones and Bartlett Publishers, 9 th edition, 2013.

Assessment methods and criteria:

Continuous assessment is implemented in the course and all learning tasks are evaluated. All students complete the course in a final examination. 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:

-

488142A: Environmental legislation and EIA, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Anna-Kaisa Ronkanen

Opintokohteen kielet: Finnish

Leikkaavuudet:

454541A	Built Environment	5.0 op
485022A	Fundamentals of built environment	5.0 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

Finnish

Timing:

The course is held in the spring semester during the period 3

Learning outcomes:

Upon completion of the course, the student know environmental legislation system in Finland and hierarcy of environmental authorities. She/He also will be able to explain differences between environmental permission and environmental impact assessment (EIA) and know the steps in the EIA process. She/He also know what kind of projects need to go trough EIA. Spesific areas in the course are mining, energy and water issues.

Contents:

Finnish law, EU directives.

Mode of delivery:

Face-to-face teaching and independent work with selected projects.

Learning activities and teaching methods:

Lectures 18 h /seminars 8 h / independent work with project topic 107 h. Totally 133 h. The project work are completed as a group work.

Target group:

Students in the bachelor programs of process and environmental engineering, mining school

Recommended or required reading:

Ympäristöoikeuden pääpiirteet (Ekroos, Kumpula 2010, ISBN: 9789510361283)

Assessment methods and criteria:

The student participate in the organized seminars by presenting the project work, being as a opponent to other group and peer reviewing other’s presentation. Attendance to the seminar is combulsory and absence must be compensate. Also two learing diaries are required from the lectures. The final grade of the course is weighted average of project report (40%), seminar presentation (30%), seminar activities (10%) and learning diaries (20%).

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:

The main of the course lectures are given by Suomen juristit Oy. The selected project topic is relating to true environmental projects that brings learning outcomes from the course.

Other information:

Only students from target gourp can be accepted to the course

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:

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 (36 hours) + self study. Only in Finnish.

Target group:

Students of process and environmental 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:

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:

There is no direct working life cooperation in this course.

Other information:

-

488130A: Waste management and resources recovery, 5 op

Voimassaolo: 28.11.2016 - 31.07.2018

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eva Pongracz

Opintokohteen kielet: English

Leikkaavuudet:

488505A	Waste managemet and recycling	5.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

Timing:

The course unit is held 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 and resources recovery. She/he will get basic knowledge about waste treatment and resources recovery 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, material and energy recovery methods, international treaties related to waste management, waste to energy principle, etc.

Mode of delivery:

Face-to-face teaching and guided assignments.

Learning activities and teaching methods:

Learning methods: A) Active learning method: Lectures (30 h), group work/ exercises (50 h), self-study for examination and completion of exercises (50 h) and field visits (5 h) or alternatively; B) Passive learning method (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 bachelor program of environmental engineering

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 passive mode: achieving a passing grade (1-5) in the exam which is based on provided reference material. Note that passive mode can only be followed under special circumstances.

Grading:

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

Person responsible:

Post-doctoral researcher Dr Elisangela Heiderscheidt

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

Opettajat: Elisa Koivuranta, Petri Tervasmäki

Opintokohteen kielet: English

Leikkaavuudet:

488054A	Introduction to Bioproduct and Bioprocess engineering	5.0 op
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 /135 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:

This course utilizes continuous assessment including lecture exams with potential web learning. 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 unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Elisa Koivuranta, Petri Tervasmäki

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

Opettajat: Johanna Panula-Perälä

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 /135 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:

Johanna Panula-Perälä

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:

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-economic performance of the process based on holistic criteria.

Contents:

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

Dr Jani Kangas

Working life cooperation:

-

Other information:

-

A432128: Module Preparing for the Option: Environmental Engineering/Water and Geo Engineering, 40 op

Voimassaolo: 01.08.2017 -

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.

Choose the other

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: Hiltunen, Jukka Antero
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.

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

Opettajat: Väisänen, Virpi Maria

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 and environmental conservation. 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 environmental toxicology.

Contents:

Principles of environmental ecology. Global and regional environmental problems and their effects. Principles of environmental toxicology. Engineering and environmental ethics.

Mode of delivery:

e-learning

Learning activities and teaching methods:

Individual e-learning 133 h following the schedule of the course.

Target group:

Bachelor's degree students of environmental engineering. International exchange students.

Recommended optional programme components:

-

Recommended or required reading:

Chiras D.: Environmental Science. New York, Jones and Bartlett Publishers, 9 th edition, 2013.

Assessment methods and criteria:

Continuous assessment is implemented in the course and all learning tasks are evaluated. All students complete the course in a final examination. 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:

-

488142A: Environmental legislation and EIA, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Anna-Kaisa Ronkanen

Opintokohteen kielet: Finnish

Leikkaavuudet:

454541A	Built Environment	5.0 op
485022A	Fundamentals of built environment	5.0 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

Finnish

Timing:

The course is held in the spring semester during the period 3

Learning outcomes:

Upon completion of the course, the student know environmental legislation system in Finland and hierarcy of environmental authorities. She/He also will be able to explain differences between environmental permission and environmental impact assessment (EIA) and know the steps in the EIA process. She/He also know what kind of projects need to go trough EIA. Spesific areas in the course are mining, energy and water issues.

Contents:

Finnish law, EU directives.

Mode of delivery:

Face-to-face teaching and independent work with selected projects.

Learning activities and teaching methods:

Lectures 18 h /seminars 8 h / independent work with project topic 107 h. Totally 133 h. The project work are completed as a group work.

Target group:

Students in the bachelor programs of process and environmental engineering, mining school

Recommended or required reading:

Ympäristöoikeuden pääpiirteet (Ekroos, Kumpula 2010, ISBN: 9789510361283)

Assessment methods and criteria:

The student participate in the organized seminars by presenting the project work, being as a opponent to other group and peer reviewing other's presentation. Attendance to the seminar is combulsory and absence must be compensate. Also two learing diaries are required from the lectures. The final grade of the course is weighted average of project report (40%), seminar presentation (30%), seminar activities (10%) and learning diaries (20%).

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:

The main of the course lectures are given by Suomen juristit Oy. The selected project topic is relating to true environmental projects that brings learning outcomes from the course.

Other information:

Only students from target gourp can be accepted to the course

488130A: Waste management and resources recovery, 5 op

Voimassaolo: 28.11.2016 - 31.07.2018

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eva Pongracz

Opintokohteen kielet: English

Leikkaavuudet:

488505A	Waste managemet and recycling	5.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

Timing:

The course unit is held 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 and resources recovery. She/he will get basic knowledge about waste treatment and resources recovery 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, material and energy recovery methods, international treaties related to waste management, waste to energy principle, etc.

Mode of delivery:

Face-to-face teaching and guided assignments.

Learning activities and teaching methods:

Learning methods: A) Active learning method: Lectures (30 h), group work/ exercises (50 h), self-study for examination and completion of exercises (50 h) and field visits (5 h) or alternatively; B) Passive learning method (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 bachelor program of environmental engineering

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 passive mode: achieving a passing grade (1-5) in the exam which is based on provided reference material. Note that passive mode can only be followed under special circumstances.

Grading:

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

Person responsible:

Post-doctoral researcher Dr Elisangela Heiderscheidt

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

Opettajat: Hiltunen, Jukka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

477602A	Control System Analysis	4.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish (available in English as a book exam: students will receive materials to study and take an final exam based on those materials)

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:

-

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 credits/133 hours of work

Language of instruction:

Finnish but also option to complete the course in English

Timing:

The course is held in the autumn semester during the period 1. It is recommended to complete the course at the 1st autumn semester of the international master program of environmental engineering

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 rela-tion to snowmelt, evaporation, infiltration and groundwater flow.

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.

Mode of delivery:

Face-to-face teaching and independent work with two assignment reports.

Learning activities and teaching methods:

Lectures 10 h, exercises 16 h and independent work 109 h. Totally 135 h.

Target group:

Students in international master programs of environmental engineering

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the following course or having corresponding knowledge prior to enrolling for the course unit: 477201A Material and Energy Balances and 477052A Fluid mechanics.

Recommended optional programme components:

The course is a prerequisite for most of 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:

The 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 assignment reports (80%) and examination (20%).

Grading:

The 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 assignment reports (80%) and examination (20%).

Person responsible:

University Lecturer Anna-Kaisa Ronkanen

Working life cooperation:

Examples solev in the lectures based on real problems

Other information:

The English version of the course is organized parelle to Finnish version of the course.

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: Ali Torabi Haghighi

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English and Finnish

Timing:

The course unit is held in the autumn semester, during period 1

Learning outcomes:

Upon completion this course, the student will understand the fundamental of Soil mechanics, foundation engineering and soil freezing and thawing.

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 (30 h) and calculation exercises (30 h) also independent work (73 h)

Target group:

Students in Bachelor and Master programs of environmental engineering and civil engineering

Prerequisites and co-requisites:

No

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout and other materials delivered in lectures, Principles of Geotechnical Engineering by Das, B.M and An Introduction to Geotechnical Engineering, By Holtz, R.D. and Kovacs, W.D.

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:

University teacher Ali Torabi Haghighi

Working life cooperation:

No

Other information:

Lectures are mostly in English and exercises mostly in Finnish but the student can complete the course using both languages.

485021A: Construction Contracting, 5 op

Voimassaolo: 01.08.2018 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Civil Engineering field

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

488119A	Basics of infrastructure planning and development	5.0 op
466113S	Construction economics	5.0 op
460165A-02	Introduction to Construction Economics I, practical work	0.0 op
460165A-01	Introduction to Construction Economics I, examination	0.0 op

Other information:

This Course replaces courses 466113S and 488119A.

H432236: Bachelor’s Thesis, Process and Environmental Engineering, 8 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Intermediate Studies
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Choose the Other

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

ECTS Credits:

8 ECTS

Language of instruction:

Finnish, can be written in English if needed.

Timing:

The end of Bachelor's studies

Learning outcomes:

Upon completion of the thesis the student can create a research plan, and define a research problem and research questions. She/He is able to manage her/his own work according to the project plan. The student can also utilize different information sources and critically evaluate the information obtained. The student is able to produce clear and finalized text, in line with technical and scientific writing practices.

Contents:

The student chooses the theme for the thesis in cooperation with his/her supervisor.

Mode of delivery:

The thesis is written towards the end of the BSc studies, typically during the third year.

Learning activities and teaching methods:

Independent work.

Target group:

Bachelor Students of Process Engineering.

Prerequisites and co-requisites:

Basic and intermediate studies.

Recommended optional programme components:

Information Skills and Technical communication

Assessment methods and criteria:

BSc thesis and related maturity test.

Grading:

pass/fail.

Person responsible:

The supervisor of Thesis

Working life cooperation:

Thesis' theme is often selected from the real research project or it is possible to do with industrial company.

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

ECTS Credits:

8 ECTS

Language of instruction:

Finnish, can be written in English if needed.

Timing:

The end of Bachelor's studies

Learning outcomes:

Upon completion of the thesis the student can create a research plan, and define a research problem and research questions. She/He is able to manage her/his own work according to the project plan. The student can also utilize different information sources and critically evaluate the information obtained. The student is able to produce clear and finalized text, in line with technical and scientific writing practices.

Contents:

The student chooses the theme for the thesis in cooperation with his/her supervisor.

Mode of delivery:

The thesis is written towards the end of the BSc studies, typically during the third year.

Learning activities and teaching methods:

Independent work.

Target group:

Bachelor Students of Environmental Engineering.

Prerequisites and co-requisites:

Basic and intermediate studies.

Recommended optional programme components:

Information Skills and Technical communication

Assessment methods and criteria:

BSc thesis and related maturity test.

Grading:

pass/fail

Person responsible:

The supervisor of Thesis

Working life cooperation:

Thesis' theme is often selected from the real research project or it is possible to do with industrial company.

900060A: Technical Communication, 2 op

Voimassaolo: 01.08.2005 - 31.07.2021

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

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:
1st year: Process and Environmental Engineering
2nd year: Communications Technologies
3rd year: Geoscience; Mechanical Engineering; Electrical Engineering, Computer Science and Engineering Technologies

Mode of delivery:
Multimodal teaching
Learning activities and teaching methods:
Contact hours ca. 20 h and independent group work or self-study ca. 34 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.

Tutkintorakenteisiin kuulumattomien opintokokonaisuuksien ja -jaksojen kuvaukset

466113S: Construction economics, 5 op

Voimassaolo: 01.08.2015 - 31.07.2018

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Rauno Heikkilä

Opintokohteen kielet: Finnish

Leikkaavuudet:

485021A	Construction Contracting	5.0 op
460165A-01	Introduction to Construction Economics I, examination	0.0 op
460165A-02	Introduction to Construction Economics I, practical work	0.0 op
460165A	Introduction to Construction Economics I	3.0 op

ECTS Credits:
5 ECTS credits / 132 hours of work
Language of instruction:
Finnish
Timing:
Autumn, period 2
Learning outcomes:
The student know the role of the construction sector in national economy. He can classify life cycle stages in construction, he know cost steering methods, production planning and tasks in a construction site control. The student know sources of data for cost control and can estimate a bid in tendering. Profitability of investments can be assessed and financial aspects in energy and LCC calculations can be carried out. Financing calculations with rental cost assessment will be studied. The student know principles of contract administration and contract types and can explain the actions of contractors and construction managers in construction projects. The student will become acquainted with some features of human resource management, business management and production management. The student can plan general time- table, building site plan, work package plan and week schedule in construction. Procurement and machinery plan include the course.
Contents:
The effects of construction sector in the society. Public administration and regulation in construction sector. Life cycle, cost engineering and cost control in construction project. Design guidance and control budget. Implementation and building contract forms. Introduction to project management, critical path networks and arrow networks, schedules. Cost estimates and investment calculations. Bids, energy calculations, building maintenance and ecology in building. Construction activities, site planning and planning periods. Control budget. Safety and health and quality assurance. Basic functions in a construction enterprise. General conditions in contracts, agreements. Procurements, Lean in construction. Labor law. Enterprise cases and software applications.
Mode of delivery:
Lecture room teaching.
Learning activities and teaching methods:
Lectures 24 h /exercises 47 h independently or in groups self-study and exams 65 h. Total 136 h/5 ECTS credits.
Target group:
Bachelor level students
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:
Educational handouts and materials, Educational materials in information network, Recommended literature: Finnish literature, see adjacent text

Reference literature: Barrie, Donald. S. & Paulson , Boyd C. 1992 or newer. Professional Construction Management.New York. McGraw-Hill.inc. pp.1-55. Part 1. Construction industry and practice, pp 252-306. Planning and Control of Operatios and Resources. (577. p.).; Ashworth, Allan, 1999(or newer). Cost Studies of Building. Addison Wesley Longman Ltd, Chapters 18-19. pp.330-382 Life-cycle costing 1-2. ja Chapter 17. pp. 383-395. Value management. Chapt.11. pp. 213-243 :Development appraisal. Ashworth Allan& Hogg, Keith.2000. Added Value in Design and Construction. Longman. Pearson education. 154 p; Jeffrey K.Liker.2001. The Toyota Way. McGraw-Hill. 330 p.; Information in Network. www. rakennustieto.fi. RATU, RT, KH.KONERATU. Http://www. rakennustieto.fi/index/tuotteet/ratu.html. Kirjautuminen.
http://www.rakennustieto.fi/index/tuotteet/rt.html; Quality in Network
http://www.qualitygurus.com/gurus/list-of-gurus/jeffrey-k-liker/; Crainer Stuart. 1998. The Ultimate Business Guru Book.Capsone.Oxford. 314 p.

Assessment methods and criteria:

Examination and accepted home work assignments.

Grading:

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

Person responsible:

professor Rauno Heikkilä