Opasraportti

FTech - Field of Process and Environmental Engineering (2020 - 2021)

University's new study guide for academic year 2020-2021 is published at https://opas.peppi.oulu.fi

The study guide includes information on degrees, curriculums, courses and course timetables. Course registrations are still done in Oodi.

If you have questions on information in the study guide, please contact the study field's Academic Affairs Service Team https://www.oulu.fi/forstudents/faculty-study-affairs

Tutkintorakenteet

Master of Science (Tech), Process Engineering

Tutkintorakenteen tila: published

Lukuvuosi: 2020-21

Lukuvuoden alkamispäivämäärä: 01.08.2020

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
477323A: Mass and Heat Transfer, 5 op
477221A: Material and Energy Balances, 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

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

Bioproducts and Bioprocess Engineering

H431230: Module of the Option/Bioproducts and Bioprocess Engineering, 60 op
- *Alternative*
  - A431230: Module of the Option/Bioproducts and Bioprocess Engineering, Bioproducts Technology, 31 op
    - *Compulsory*
      - 477123S: Chemical processing of biomasses, 5 op
      - 477124S: Mechanical processing of biomasses, 5 op
      - 477128S: Circular Bioeconomy, 5 op
      - 477126S: Manufacturing of fibre products, 5 op
      - 477127S: Research training of bioproduct technology, 10 op
  - A431231: Module of the Option/Bioproducts and Bioprocess Engineering, Bioprocess Engineering, 59 op
    - *Compolsory: Prerequisites for this module are following courses: 488301A Mikrobiologia (5 ECTS), and 488302A Basics of bBiotechnology (5 ECTS).*
      - 488321S: Bioreactor technology, 5 op
      - 488305S: Advanced Course for Biotechnology, 5 op
      - 488311S: Industrial Microbiology, 5 op
      - 488322S: Bioprocess Engineering, 5 op
      - 740148P: Biomolecules, 5 op
      - 740149P: Metabolism I, 4 op
      - 477506S: Modelling and Control of Biotechnical Processes, 5 op
      - 477204S: Chemical Engineering Thermodynamics, 5 op
      - 477308S: Multicomponent Mass Transfer, 5 op
      - 477306S: Non-ideal Reactors, 5 op
      - 477224S: Biorefineries, 5 op
      - 477223S: Advanced Process Design, 5 op

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

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
477420S: Current and future status of metal production, 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
477225S: Reaction Kinetics, 5 op
780660S: Advanced water treatment chemistry, 5 op
782608S: Battery chemistries and components, 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
031022P: Numerical Analysis, 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

Sustainable Energy Systems

A432236: Module of Study Option / Sustainable Energy Systems, 60 op
Energy Systems
488209S: Renewable Energy, 5 op
488507S: Energy Systems Engineering, 5 op
488506S: Sustainable Urban Energy, 5 op
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

488206S: Sustainable Energy Project, 5 op
488504S: Fundamentals of nuclear energy, 5 op
Choose 20 ECTS of Following Courses
488203S: Industrial Ecology, 5 op
488216S: Environmental Engineering Project, 5 op
488402S: Sustainable Development, 5 op
488143S: Environmental Impact Assessment, 5 op
477224S: Biorefineries, 5 op
477625S: Power Plant Automation, 5 op
782608S: Battery chemistries and components, 5 op

Industrial Environmental Engineering

A432238: Module of Study Option / Industrial Environmental Engineering, 60 op
Industrial Environmental Engineering
477309S: Process and Environmental Catalysis, 5 op
488402S: Sustainable Development, 5 op
488203S: Industrial Ecology, 5 op
488216S: Environmental Engineering Project, 5 op
488209S: Renewable Energy, 5 op
488214S: Air Pollution Control Engineering - Practical Solutions, 5 op
488215S: Industry and Environment, 5 op
477207S: Industrial Water and Wastewater Technologies, 5 op
477306S: Non-ideal Reactors, 5 op
477312S: Science and Professional Ethics, 5 op
Choose 10 ECTS of Following Courses
477224S: Biorefineries, 5 op
477223S: Advanced Process Design, 5 op
488206S: Sustainable Energy Project, 5 op
477310S: Advanced Catalytic Processes, 5 op
477311S: Advanced Separation Processes, 5 op
477225S: Reaction Kinetics, 5 op
488143S: Environmental Impact Assessment, 5 op
477307S: Research Methodology, 5 op

Hydrology and Water Management

A432237: Module of Study Option / Hydrology and Water Management, 60 op
Hydrology and Water Management
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
488144A: Water distribution and sewage networks, 5 op
488143S: Environmental Impact Assessment, 5 op
488136S: Integrated water resources management, 5 op
Choose 25 ECTS of Following Courses
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
488131S: Geoenvironmental Engineering, 5 op
488145S: Data analysis for Water Resources, 5 op
488146S: Urban water management, 5 op

Industrial Engineering

A433246: Process and Environmental Engineering / Supplementary Module, Industrial Engineering, 30 op
Industrial Engineering
555285A: Project management, 5 op
555242A: Product development, 5 op
555226A: Operations and supply chain management, 5 op
555286A: Process and quality management, 5 op

555390S: Process Analytics, 5 op
555389S: Systematic Process Improvement, 10 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: 2020-21

Lukuvuoden alkamispäivämäärä: 01.08.2020

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
477304A: Separation Processes, 5 op
477401A: Thermodynamic Equilibria, 5 op
488102A: Hydrological Processes, 5 op
031076P: Differential Equations, 5 op
031075P: Calculus II, 5 op
031078P: Matrix Algebra, 5 op
477222A: Reactor Analysis, 5 op
477052A: Fluid Mechanics, 5 op
477323A: Mass and Heat Transfer, 5 op
477221A: Material and Energy Balances, 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.

Sustainable Energy Systems

A432236: Module of Study Option / Sustainable Energy Systems, 60 op
Energy Systems
488209S: Renewable Energy, 5 op
488507S: Energy Systems Engineering, 5 op
488506S: Sustainable Urban Energy, 5 op
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
488206S: Sustainable Energy Project, 5 op
488504S: Fundamentals of nuclear energy, 5 op
Choose 20 ECTS of Following Courses
488203S: Industrial Ecology, 5 op
488216S: Environmental Engineering Project, 5 op
488402S: Sustainable Development, 5 op
488143S: Environmental Impact Assessment, 5 op

477224S: Biorefineries, 5 op
477625S: Power Plant Automation, 5 op
782608S: Battery chemistries and components, 5 op

Industrial Environmental Engineering

A432238: Module of Study Option / Industrial Environmental Engineering, 60 op
Industrial Environmental Engineering
477309S: Process and Environmental Catalysis, 5 op
488402S: Sustainable Development, 5 op
488203S: Industrial Ecology, 5 op
488216S: Environmental Engineering Project, 5 op
488209S: Renewable Energy, 5 op
488214S: Air Pollution Control Engineering - Practical Solutions, 5 op
488215S: Industry and Environment, 5 op
477207S: Industrial Water and Wastewater Technologies, 5 op
477306S: Non-ideal Reactors, 5 op
477312S: Science and Professional Ethics, 5 op
Choose 10 ECTS of Following Courses
477224S: Biorefineries, 5 op
477223S: Advanced Process Design, 5 op
488206S: Sustainable Energy Project, 5 op
477310S: Advanced Catalytic Processes, 5 op
477311S: Advanced Separation Processes, 5 op
477225S: Reaction Kinetics, 5 op
488143S: Environmental Impact Assessment, 5 op
477307S: Research Methodology, 5 op

Hydrology and Water Management

A432237: Module of Study Option / Hydrology and Water Management, 60 op
Hydrology and Water Management
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
488144A: Water distribution and sewage networks, 5 op
488143S: Environmental Impact Assessment, 5 op
488136S: Integrated water resources management, 5 op
Choose 25 ECTS of Following Courses
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
488131S: Geoenvironmental Engineering, 5 op
488145S: Data analysis for Water Resources, 5 op
488146S: Urban water management, 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
031022P: Numerical Analysis, 5 op

For International Master's Degree Students

A433247: Supplementary module for International Master's Degree Students, 20 op
For Environmental Engineering foreign students
030008P: Information Skills for foreign degree students, 1 op
For study option "Hydrology and water management"
488102A: Hydrological Processes, 5 op

Finnish, choose at least 5 ECTS
900017Y: Survival Finnish, 2 op
900013Y: Beginners' Finnish Course 1, 3 op
900053Y: Beginners' Finnish Course 2, 5 op
900015Y: Intermediate Finnish Course 1, 5 op
900016Y: Intermediate Finnish Course 2, 5 op
900027Y: Special Course in Finnish: Writing Skills, 3 op
900054Y: Conversational Skills in Finnish, 3 op

Free choice courses

Automation Engineering

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

Bioproducts and Bioprocess Engineering

H431230: Module of the Option/Bioproducts and Bioprocess Engineering, 60 op
Alternative
A431230: Module of the Option/Bioproducts and Bioprocess Engineering, Bioproducts Technology, 31 op
Compulsory
477123S: Chemical processing of biomasses, 5 op
477124S: Mechanical processing of biomasses, 5 op
477128S: Circular Bioeconomy, 5 op
477126S: Manufacturing of fibre products, 5 op
477127S: Research training of bioproduct technology, 10 op
A431231: Module of the Option/Bioproducts and Bioprocess Engineering, Bioprocess Engineering, 59 op
Compolsory: Prerequisites for this module are following courses: 488301A Mikrobiologia (5 ECTS), and 488302A Basics of bBiotechnology (5 ECTS).
488321S: Bioreactor technology, 5 op
488305S: Advanced Course for Biotechnology, 5 op
488311S: Industrial Microbiology, 5 op
488322S: Bioprocess Engineering, 5 op
740148P: Biomolecules, 5 op
740149P: Metabolism I, 4 op
477506S: Modelling and Control of Biotechnical Processes, 5 op
477204S: Chemical Engineering Thermodynamics, 5 op
477308S: Multicomponent Mass Transfer, 5 op
477306S: Non-ideal Reactors, 5 op
477224S: Biorefineries, 5 op
477223S: Advanced Process Design, 5 op

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

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
477420S: Current and future status of metal production, 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
477225S: Reaction Kinetics, 5 op
780660S: Advanced water treatment chemistry, 5 op
782608S: Battery chemistries and components, 5 op

Industrial Engineering

A433246: Process and Environmental Engineering / Supplementary Module, Industrial Engineering, 30 op
Industrial Engineering
555285A: Project management, 5 op
555242A: Product development, 5 op
555226A: Operations and supply chain management, 5 op
555286A: Process and quality management, 5 op
555390S: Process Analytics, 5 op
555389S: Systematic Process Improvement, 10 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 Engineering

Tutkintorakenteen tila: published

Lukuvuosi: 2020-21

Lukuvuoden alkamispäivämäärä: 01.08.2020

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
031078P: Matrix Algebra, 5 op
031075P: Calculus II, 5 op
031021P: Probability and Mathematical Statistics, 5 op
031076P: Differential Equations, 5 op
761118P: Mechanics 1, 5 op
780123P: Introductory Laboratory Works in Chemistry, 5 op
780116P: Introduction to Organic Chemistry, 5 op
555265P: Occupational Safety and Health Management, 5 op
030005P: Information Skills, 1 op

Choose 2 courses

488051A: AutoCAD and Matlab in Process and Environmental Engineering, 5 op
780120P: Basic Principles in Chemistry, 5 op
521141P: Elementary Programming, 5 op
811104P: Programming 1, 5 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

Choose Languages, 6 ECTS English or German

902150Y: Professional English for Technology, 2 op
902141Y: Oral Fluency, 2 op
902142Y: Business Correspondence, 2 op
902144Y: Environmental Issues, 2 op
902145Y: Working Life Skills, 2 op
902147Y: Academic Vocabulary for Science and Technology, 2 op
902149Y: Mechanics of Writing, 2 op
902121Y: Other Studies in English (level B2), 2 - 8 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

Intermediate Studies (60 op)

A431125: Intermediate Studies, Process Engineering, 60 op

Intermediate studies

555225P: Basics of industrial engineering and management, 5 op
477221A: Material and Energy Balances, 5 op
477401A: Thermodynamic Equilibria, 5 op
477052A: Fluid Mechanics, 5 op
477323A: Mass and Heat Transfer, 5 op
477120A: Fluid and Particle Engineering, 5 op
477222A: Reactor Analysis, 5 op
477427A: High temperature processes, 5 op
477051A: Automation Engineering, 5 op
477502A: Experiment design and analysis, 5 op
491101P: Introduction to mining, 5 op
477004A: Practical Training, 5 op

Module preparing for the Option (40 op)

Choose one of following modules.

If you are student of Process Engineering, you can chooce "Mineral Processing".

Process Engineering

A433127: Process and Environmental Engineering, Module preparing for the Option / Process Engineering, 40 op

Process Engineering

- 477402A: Solid Inorganic Materials, 5 op
- 477304A: Separation Processes, 5 op
- 488212A: Fundamentals of catalysis, 5 op
- 488054A: Introduction to Bioproduct and Bioprocess engineering, 5 op
- 477203A: Process Design, 5 op
- 477621A: Control System Analysis, 5 op
- 477622A: Control System Design, 5 op
- 477501A: Process dynamics, 5 op

Mining Engineering

A433126: Process and Environmental Engineering, Module preparing for the Option /Mineral Processing, 40 op

Mineral Processing

- 477402A: Solid Inorganic Materials, 5 op
- 771113P: Introduction to Geology I, 5 op
- 771117P: Basic course in mineralogy, 5 op
- 477304A: Separation Processes, 5 op
- 493300A: Principles of mineral processing, 5 op
- 488142A: Environmental legislation and EIA, 5 op
- 774311A: A Basic Course in Geochemistry, 5 op
- 493302A: Chemical phenomena in mineral processes, 5 op

Bachelor's Thesis (10 op)

Choose right Bachelor's Thesis.

477990A: Bachelor's Thesis / Process Engineering, 8 op
477994A: Maturity Test / Bachelor of Science in Process Engineering Technology, 0 op
900060A: Technical Communication, 2 op

Bachelor of Science (Tech), Environmental Engineering

Tutkintorakenteen tila: published

Lukuvuosi: 2020-21

Lukuvuoden alkamispäivämäärä: 01.08.2020

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
- 031078P: Matrix Algebra, 5 op
- 031075P: Calculus II, 5 op
- 031021P: Probability and Mathematical Statistics, 5 op
- 031076P: Differential Equations, 5 op
- 761118P: Mechanics 1, 5 op
- 780123P: Introductory Laboratory Works in Chemistry, 5 op
- 780116P: Introduction to Organic Chemistry, 5 op
- 555265P: Occupational Safety and Health Management, 5 op
- 030005P: Information Skills, 1 op

Choose 2 courses

- 488051A: AutoCAD and Matlab in Process and Environmental Engineering, 5 op
- 780120P: Basic Principles in Chemistry, 5 op

521141P: Elementary Programming, 5 op
811104P: Programming 1, 5 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
Choose Languages, 6 ECTS English or German
902150Y: Professional English for Technology, 2 op
902141Y: Oral Fluency, 2 op
902142Y: Business Correspondence, 2 op
902144Y: Environmental Issues, 2 op
902145Y: Working Life Skills, 2 op
902147Y: Academic Vocabulary for Science and Technology, 2 op
902149Y: Mechanics of Writing, 2 op
902121Y: Other Studies in English (level B2), 2 - 8 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

Intermediate Studies (60 op)

A432125: Intermediate Studies, Environmental Engineering, 60 op
Intermediate Studies
488210A: Environmental science and technology, 5 op
488505A: Waste managemet and recycling, 5 op
477401A: Thermodynamic Equilibria, 5 op
477221A: Material and Energy Balances, 5 op
477052A: Fluid Mechanics, 5 op
477222A: Reactor Analysis, 5 op
477323A: Mass and Heat Transfer, 5 op
477502A: Experiment design and analysis, 5 op
477304A: Separation Processes, 5 op
488212A: Fundamentals of catalysis, 5 op
477004A: Practical Training, 5 op
Choose the Other
555225P: Basics of industrial engineering and management, 5 op
485021A: Construction Contracting, 5 op

Module preparing for the Option (40 op)

Choose one of following modules.

If you are student of Process Engineering, you can chooce "Mineral Processing".

Environmental Engineering

A433128: Process and Environmental Engineering, Module preparing for the Option / Environmental Processing, 40 op
Environmental Engineering
488102A: Hydrological Processes, 5 op
488142A: Environmental legislation and EIA, 5 op
488211A: Environmental engineering in industry and municipalities, 5 op
485301A: Basics of Geotechnics, 5 op
488208A: Basics of production and use of energy, 5 op
781309A: Environmental Chemistry, 5 op
488213A: Sources and control of air pollution, 5 op
488053A: Enviromental monitoring and analysis, 5 op

Bachelor's Thesis (10 op)

Choose right Bachelor's Thesis.

488990A: Bachelor's Thesis / Enviromental Engineering, 8 op
488994A: MaturityTest/Bachelor of Science in Environmental Engineering/Technology, 0 op
900060A: Technical Communication, 2 op

Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

488052A: Introduction to Bioproduct and Bioprocess engineering, 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: Pauliina Uusitalo
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:

Online teaching

Learning activities and teaching methods:

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

Target group:

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Prerequisites and co-requisites:

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

Recommended optional programme components:

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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. The exams are remote exams. It is possibility to take exams also at the university.
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:

Pauliina Uusitalo

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:

Online teaching, Stack/Moodle digital learning environment

Learning activities and teaching methods:

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

Target group:

1. year students of engineering, 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:

Recommended 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:

No

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:

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Recommended optional programme components:

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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: Ahola, Juha Lennart

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:

The student is able to identify the activities of process design and the know-how needed at different design stages. The student is capable of utilising process synthesis and analysis tools for creating a preliminary process concept and pointing out the techno-economic performance of the process concept 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 applicable for preliminary process and plant design.

Mode of delivery:

Lectures and process design exercises in groups.

Learning activities and teaching methods:

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

Target group:

Bachelor students in Process and Environmental Engineering.

Prerequisites and co-requisites:

Objectives of 477202A Reactor analysis and 477304A Separation processes.

Recommended optional programme components:

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Recommended or required reading:

Lecture handouts, Seider, W.D., Seader, 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 a final exam or two midterm exams and group 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:

Examination. The course can be completed with three 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 https://www.oulu.fi/forstudents/assesment-criteria.

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

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' and 'Material and Energy Balances' 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	Particle Technology	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.

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:

477013P Introduction to process and environmental engineering

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 two intermediate exams with group 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

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	Bulk Solids Handling	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 and rheology, pumping and hydraulic transport, mixing. Gases and aerodispersions: compression, pneumatic transport. Granular bulk material: properties, storage, mechanical transportation, blending and 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 or required reading:

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

Assessment methods and criteria:

This course utilizes continuous 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:

No

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: Marja Mikola

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 about 30 h, exercises about 10 h and self-study about 90 h.

Target group:

Bachelor students in process and environmental engineering, minor subject students

Prerequisites and co-requisites:

Objectives of Material and Energy Balances and Thermodynamic Equilibrium

Recommended optional programme components:

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Recommended or required reading:

Lecture handouts
Levenspiel, O.: Chemical Reaction Engineering. John Wiley & Sons, 1972. or newer (parts)
Atkins, P.W.: Physical Chemistry, Oxford University Press, 2002. 7. edition or newer (parts)

Assessment methods and criteria:

Two midterm exams during the course, which can be replaced with final exam after the course and two exercises.

Grading:

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

Person responsible:

Marja Mikola

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. 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., Okiishi, T.H., Huebsch W.W. & Rothmayer A.P. Fluid Mechanics, 7. painos, Wiley 2013. ISBN 978-1-118-318676
or
Gerhart, Gerhart, Hochstein 2017. Munson's Fluid Mechanics. ISBN 978-1-119-24898-9.

Assessment methods and criteria:

This course utilizes continuous assessment. During the course there are 3 intermediate exams in Finnish. 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

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:

Jukka Hiltunen ja Enso Ikonen

Working life cooperation:

No

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: Ikonen, Mika Enso-Veitikka

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

477323A: Mass and Heat Transfer, 5 op

Voimassaolo: 01.08.2019 -

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:

477322A	Heat and Mass Transfer	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 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:

Welty J.R., Rorrer G.L. & Foster D.G. Fundamentals of Momentum, Heat and Mass Transfer, International student version, 6. painos, Wiley 2015,ISBN 978-1-118-80887-0, parts 14-28.

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:

Replaces the course 477322A Lämmön ja aineensiirto, 5 ects.

477221A: Material and Energy Balances, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Marja Mikola

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay477231A	Material and Energy Balances I (OPEN UNI)	2.0 op
ay477232A	Material and Energy Balances II (OPEN UNI)	3.0 op
ay477221A	Material and Energy Balances (OPEN UNI)	5.0 op
477201A	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. Multiunit cases are also considered.

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, minor subject students in relevant disciplines.

Prerequisites and co-requisites:

High school level chemistry, mathematics and physics.

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:

Reklaitis, G.V.: Introduction to Material and Energy Balances. John Wiley & Sons, 1983. ISBN 0-471-041319.

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.

Person responsible:

Juha Ahola

Other information:

This course replaces the course 477201A Material and Energy Balances, 5 ects.

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: Markku Ohenoja

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:

Face-to-face teaching and exercises.

Learning activities and teaching methods:

The amount of guided teaching is 32 hours. Contact teaching includes, depending on situation, lectures, exercises and seminars. 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:

No prerequisites, but Matlab programming skills and understanding of process dynamics are a benefit.

Recommended optional programme components:

Courses 488051A AutoCAD and Matlab in Process and Environmental Engineering and 477501A Process Dynamics support the implementation of 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, seminar presentation and the final report.

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.) Markku Ohenoja

Working life cooperation:

No

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 understands the basic of evolutionary optimization algorithms and can use them. 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. Evolutionary algorithms in optimization. Applications in process engineering.

Mode of delivery:

Face-to-face teaching and exercises.

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 homework and classroom or home exams.

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

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 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:

This course changes to course 477610S (5 ETCS) in Academic year 21-22.

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: István Selek

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:

English

Timing:

Period 1 (autumn term)

Learning outcomes:

After completing the course, one understands the relevance and building blocks of model-based control design and system analysis. Relying on data-driven approaches, this course provides strong foundations for digital control design considering real-life applications.

Contents:

1. Control theory of linear time-invariant (LTI) systems in discrete-time (digital control). State-space representation and system analysis in time domain. Controllability, observability and related concepts. Relation of the static state feedback with PID control. Stability in Lyapunov sense. 2. Basics of LTI model identification using data. Model order reduction, model uncertainty. The relevance of LTI theory in the control of nonlinear systems. 3. Laboratory exercises with the Valmet DNA automation system.

Mode of delivery:

Regular lectures

Learning activities and teaching methods:

Lectures and exercises including 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 are recommended beforehand.

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.

Assessment methods and criteria:

Completition of homeworks and final (written) exam.

Grading:

Numerical grading scale 1-5 or fail.

Person responsible:

István Selek

Working life cooperation:

No

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: Aki Sorsa
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 is able to explain the operation principles of genetic algorithms and to use them in tuning of fuzzy set systems and neural network models.

Contents:

Fuzzy logic and fuzzy set systems, fuzzy calculus, fuzzy modelling and control, neural computation, neuro-fuzzy methods and evolutionary computation.

Mode of delivery:

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

Learning activities and teaching methods:

The amount of guided teaching is 40 hrs including lectures, exercises and a possible seminar presentation. As a self-study, students carry out homework, case study and seminar presentation preparation.

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 materials. Other literature.

Assessment methods and criteria:

This course uses continuous assessment that includes homework, classroom or home exams, case study and a possible seminar 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 uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Aki Sorsa

Working life cooperation:

No

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.

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 study the effect of sampling on the 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:

The lectures and exercise classes will be arranged as distance learning via Zoom. The Zoom-links, directions and other material (in Finnish) will be made available in the Moodle-workspace for the course, which can be found at https://moodle.oulu.fi/course/view.php?id=5361

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 Processing. Shanmugan, K.S., Breipohl, A.M.: Random Signals, Detection, Estimation and Data Analysis.

Assessment methods and criteria:

The course is completed with mid-term exams or a final exam. When completed with mid-term exams, exercise assignments are part of the continuous assessment. The assessment of the course is based on the learning outcomes of the course.

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:

-

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: Mika Ruusunen

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, students can model kinetics and dynamics of bio-technical processes (mainly fermentation) starting from the process phenomena and mass balance models. They also understands the limitations of different approaches and the modelling assumptions. They also have preliminary skills to develop models in Matlab/Simulink environment. In addition, students understand fundamentals on monitoring and optimization of bioprocesses with respect to energy, economic, and environmental issues.

Contents:

Bioreactors: models, kinetics and transfer phenomena. Models: different modelling approaches with examples. Measurements and control aspects in 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 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 the assesment criteria at University of Oulu webpage: https://www.oulu.fi/forstudents/assesment-criteria.

Grading:

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

Person responsible:

Aki Sorsa

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 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 https://www.oulu.fi/forstudents/assesment-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

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.

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: https://www.oulu.fi/forstudents/assesment-criteria .

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

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

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: Markku Ohenoja

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, optimization 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 or required reading:

Lecture notes in English

Assessment methods and criteria:

Lecture exams. Final exam is also possible.

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.) Markku Ohenoja

Working life cooperation:

No

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
Opettajat: Hiltunen, Jukka Antero
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

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

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

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

477123S: Chemical processing of biomasses, 5 op

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

477104S	Chemical Pulping	3.0 op

ECTS Credits:

5 ECTS /133 h of work

Language of instruction:

English

Timing:

Implementation in autumn period 1

Learning outcomes:

Upon completion of the course, a student should be able to explain the value chain of chemical processing of renewable lignocellulosic raw materials to pulp and different end-products. A student is able to 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 get familiar with novel bioproduct applications.

Contents:

Lignocellulosic raw materials, fundamentals of chemical pulping, recovering of chemicals in kraft pulping, fiberline in kraft pulping, side products, environmental aspects and novel applications.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures and exercises max. 20 h, homework and self-study 113 hours.

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 intermediate exam with web learning and homework. Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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 Pulping	3.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

English

Timing:

Implementation in autumn period 2.

Learning outcomes:

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

Contents:

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

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

The implementation methods of the course vary. Lectures and exercises max. 34 h, web learning and self-study 99 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 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 intermediate exam(s) with potential web learning and homework. Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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.

477128S: Circular Bioeconomy, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisa Koivuranta

Opintokohteen kielet: English

Leikkaavuudet:

ay477128S	Circular Bioeconomy (OPEN UNI)	5.0 op
477125S	Recycling of bioproducts	5.0 op
477106S	Recycling of Bioproducts	3.0 op

ECTS Credits:

5 cr

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 residues from forest industry. Student is familiarized with circular bioeconomy at the state-of-art level. Student is able to identify the challenges (properties, transportation ect.) of raw materials and their processing, can propose solutions and has ability to review the sustainability of final products.

Contents:

Reuse, recycling and utilization of bioproducts and side streams of forest industry in accordance with principles of circular bioeconomy. The properties and processing of raw material. Novel applications in circular bioeconomy.

Mode of delivery:

Lectures, group meetings and project work.

Learning activities and teaching methods:

Work load in the course is totally 133h. The number of lectures can vary but project working is main activities in the course.

Target group:

Students interested in circular bioeconomy.

Prerequisites and co-requisites:

488052A Introduction to Bioproduct and Bioprocess Engineering is recommended.

Recommended or required reading:

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

Assessment methods and criteria:

The assignment and seminar. More information about assessment methods is given during the course.

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:

This Course replace course 477125S Recycling of bioproducts, 5 cr.

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 and Board Manufacturing	3.0 op
477106S	Recycling of Bioproducts	3.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

Finnish

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 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:

Examination and other evaluation methods.

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.

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 Bioproduct 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.

Target group:

Students interested in bioeconomy

Prerequisites and co-requisites:

Studies in the field of bioproduct technology are recommended

Recommended or required reading:

Materials given by a supervisor.

Assessment methods and criteria:

Evaluaton of student's working skills and evaluation of research report. Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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:

The course has ended and replaced by a new course 477130S Research training of bio and circular economy.

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

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

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

488321S: Bioreactor technology, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ville-Hermanni Sotaniemi

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 mathematically describe microbial growth and product formation, enzyme catalysis and bioreactor performance. The student will also be able to use these mathematical tools to plan and analyze 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 Michaelis-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. Mixing and power consumption. Scale-up and scale-down.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures 40 h / exercises 4 h / homework 29 h / self-study 62 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 488212A Fundamentals of Catalysis or 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering) or respective knowledge.

Recommended or required reading:

Lectures: Lecture handouts; Doran, P. M. Bioprocess engineering principles. Academic Press. London, 2012. Supplementary material: Villadsen J., Nielsen J., Liden G. Bioreactor engineering principles. Springer Verlag, 2011. Shuler ML., Kargi F. Bioprocess engineering basic consepts. 2 ed. Pearson. 2002 and 2014.

Assessment methods and criteria:

Lectures, exercises, final exam, homework. Grade will be composed of final exam, exercises and homework.

Grading:

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

Person responsible:

DI Ville Sotaniemi

Working life cooperation:

No

488305S: Advanced Course for Biotechnology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Johanna Panula-Perälä

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.

Contents:

Microbial homologous and heterologous protein production. Unit operations in product recovery and purification. Biocatalyst screening and optimization. Scale-up and intensification of bioprocesses.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures 30 h / homework 48 h / self-study 57 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 488212A Fundamentals of Catalysis or 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering and 488321S Bioreactor technology, or respective knowledge.

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.

Grading:

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

Person responsible:

TkT Johanna Panula-Perälä

Working life cooperation:

No

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: Hanna Virpiranta, Idamaria Romakkaniemi, 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:

Finnish

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 conduct bench-scale research on biotechnical processes using aseptic techniques, and to evaluate and report the results of her/his research.

Contents:

Introduction to microbial laboratory work, measurement of microbial growth, production of microbial products and calcuations related to the topic under supervision of researchers. In the end of the practicum, the student will provide an written report, including literature citations.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 2 h/ laboratory exercises 60 h/ written report and self study 73 h.

Target group:

Master’s students of bioprocess engineering (A432229 Module of the Option/Bioproducts and Bioprocess Engineering, Bioprocess Engineering).

Prerequisites and co-requisites:

Courses 488212A Fundamentals of catalysis or 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering.

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:

DI Ville-Hermanni Sotaniemi

Working life cooperation:

No

Other information:

Detailed schedule of the course is informed in the starting lecture. Course has an advanced registration. Registration closes two weeks before the course begins.

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: Johanna Panula-Perälä

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 3. It is recommended to complete the course in the 4th year.

Learning outcomes:

After completing this course, the student will be able, under supervision, to prepare a research plan for the research project and perform a laboratory scale fermentation process including pre-cultivation and downstream processing.
Student can use a modern bioreactor, its automation and different biotechnological methods needed in the protein production, fermentation processes and in protein purification. Student will be able to analyze the research results and report them in written form.

Contents:

A student will perform a biotechnical manufacturing process in a group supervised by researchers 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 /research plan 8 h/ Laboratory exercises 52 h / written report and literature research 73h

Target group:

Master students in the study option bioprocess engineering (A431231 Module of the Option /Bioproducts and Bioprocess Engineering, Bioprocess Engineering).

Prerequisites and co-requisites:

488212A Fundamentals of catalysis or 488309A Biocatalysis,
488052A Introduction to Bioproduct and Bioprocess Engineering,
488311S Industrial microbiology,
488311S Bioreactor technology
or respective knowledge.

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:

Laboratory work and written report. 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:

TkT Johanna Panula-Perälä

Working life cooperation:

No

Other information:

Detailed schedule of the course is informed in the starting lecture.
Course has an advanced registration. Registration closes two weeks before the course begins.

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

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 writing of a synopsis on this subject. The module is arranged into lectures or workshops, and writing the synopsis. All of the course materials are in English, but both English and Finnish are used in teaching. Both a final examination and continuous assessment will count towards the final mark.

Mode of delivery:

Face to face teaching

Learning activities and teaching methods:

30 h lectures, plus exercises

Target group:

Minor subject students

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Appling et al. Biochemistry – Concepts and Connections (2nd edition, 2019) Pearson Education Limited; ISBN 10: 1-292-26720-8, or equivalent

Assessment methods and criteria:

Continuous assessment, final examination

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 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:

No

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: Mika Ruusunen

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, students can model kinetics and dynamics of bio-technical processes (mainly fermentation) starting from the process phenomena and mass balance models. They also understands the limitations of different approaches and the modelling assumptions. They also have preliminary skills to develop models in Matlab/Simulink environment. In addition, students understand fundamentals on monitoring and optimization of bioprocesses with respect to energy, economic, and environmental issues.

Contents:

Bioreactors: models, kinetics and transfer phenomena. Models: different modelling approaches with examples. Measurements and control aspects in 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 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 the assesment criteria at University of Oulu webpage: https://www.oulu.fi/forstudents/assesment-criteria.

Grading:

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

Person responsible:

Aki Sorsa

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: Tanskanen, Juha Petri

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. 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, chemical reaction equilibrium, vapour/liquid equilibrium, introduction to the use of Aspen Plus in the calculation of a thermodynamic equilibrium state, 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 of Chemical Engineering, and Bioproducts and bioprocesses.

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, 2005. (7th ed.) ISBN 0-07-124708-4

Assessment methods and criteria:

Combination of a final exam and home 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 https://www.oulu.fi/forstudents/assesment-criteria.

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

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 spring semester during the 3th period. It is recommended to complete the course at the fourth (1st Master's) spring 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 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 https://www.oulu.fi/forstudents/assesment-criteria

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: 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 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

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 https://www.oulu.fi/forstudents/assesment-criteria

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

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 spring semester during the 3th period. It is recommended to complete the course at the fourth (1st Master's) spring 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 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 https://www.oulu.fi/forstudents/assesment-criteria

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:

Student recognizes the connection between catalysis and green chemistry and the role of catalysis in sustainable processes, energy production, and environmental engineering. Student is able to explain the most important industrial catalytic processes, the use of catalysts in environmental technology, and the importance of catalyst research.

Contents:

Catalyst and catalysis, sustainability. Catalysis in industry. Environmental catalysis.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 20 h, exercises 10 h, teamwork presentations 20 h, portfolio work 40 h and self-study 60 h.

Target group:

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

Prerequisites and co-requisites:

488212A Katalyysin perusteet or 488309A Biokatalyysi

Recommended or required reading:

-

Assessment methods and criteria:

Portfolio and written examination

Grading:

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

Person responsible:

Satu Pitkäaho and Esa Turpeinen

Working life cooperation:

No

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: Muurinen, Esa Ilmari

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, next time 2021-22.

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 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 https://www.oulu.fi/forstudents/assesment-criteria

Grading:

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

Person responsible:

Esa Muurinen

Working life cooperation:

No

477310S: Advanced Catalytic Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

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 (next time in Autumn 2020).

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 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 https://www.oulu.fi/forstudents/assesment-criteria .

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

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 https://www.oulu.fi/forstudents/assesment-criteria.

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

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 22h, 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:

Docent Dr Esa Muurinen

Working life cooperation:

No

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: Tanskanen, Juha Petri

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. 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, chemical reaction equilibrium, vapour/liquid equilibrium, introduction to the use of Aspen Plus in the calculation of a thermodynamic equilibrium state, 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 of Chemical Engineering, and Bioproducts and bioprocesses.

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, 2005. (7th ed.) ISBN 0-07-124708-4

Assessment methods and criteria:

Combination of a final exam and home 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: Tanskanen, Juha Petri
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:

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

Mode of delivery:

Face-to-face teaching, introductory examples and group exercises with a 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:

-

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. 3rd 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:

Numerical grading scale, 0-5. Zero stands for a fail.

Person responsible:

Dr Jani Kangas

Working life cooperation:

No

Other information:

-

477524S: Process Optimization, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

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 understands the basic of evolutionary optimization algorithms and can use them. 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. Evolutionary algorithms in optimization. Applications in process engineering.

Mode of delivery:

Face-to-face teaching and exercises.

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 homework and classroom or home exams.

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

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 https://www.oulu.fi/forstudents/assesment-criteria

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

477224S: Biorefineries, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /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 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

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.

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). 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, 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:

Although it is not required to participate on lectures, it is highly recommended that the students are active and do the required exercises from the very beginning of the course due to continuous assessment used in this course.

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.

477420S: Current and future status of metal production, 5 op

Voimassaolo: 01.08.2019 - 31.07.2021

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:

477425S	Current and future status of process industry	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 II. It is recommended to complete the course at the 5th autumn semester.

Learning outcomes:

Student can estimate how national and global trendsinfluence metal production now and in the future.

Contents:

Contents vary each year. Focus is on current issues and features e.g. availability and price of raw materials and energy, available technologies, juridical restrictions, environmental issues, digitalisation as well as research and development.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Lectures and discussions (max. 48 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 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 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 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 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.

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 ECTS credits / 134 hours of work

Language of instruction:

Finnish. English on demand.

Timing:

4th or 5th spring. The course is lectured every other year.

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

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 ECTS credits / 134 hours of work

Language of instruction:

Finnish. English on demand.

Timing:

4th or 5th spring. The course is lectured every other year.

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

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 ECTS credits / 130 hours of work

Language of instruction:

Finnish/English

Timing:

The course is held in the spring semester, during the period 4. It is recommended to complete the course at the 4th or 5th spring semester.

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, Moodle learning environment

Learning activities and teaching methods:

Lectures 40 h, self-studies 90 h of which a part is done as independent work in the learning environment.

Target group:

Chemistry, chemistry teacher, process technology

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the following courses: Physical chemistry I and 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. Examination based on the lectures.

Assessment methods and criteria:

Final examination.

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:

The course includes the guest lectures from industry.

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 ECTS credits / 134 hours of work

Language of instruction:

Finnish/English on demand

Timing:

4th or 5th spring. The course is lectured every other year.

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

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 ECTS credits / 134 hours of work

Language of instruction:

Finnish/English on demand

Timing:

4th or 5th autumn. The course is lectured every other year.

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:

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:

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

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 ECTS credits / 135 hours of work

Language of instruction:

Finnish/English

Timing:

The course is held in the autumn semester, during the period 1 (every other year). It is recommended to complete the course at the 4th or 5th autumn semester.

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, Moodle learning environment.

Learning activities and teaching methods:

Lectures 40 h, self-studies 90 h of which a part is done as independent work in the learning environment.

Target group:

Chemistry, chemistry teacher, process technology

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the following courses: Physical chemistry I and 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.

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:

The course does not contain working life cooperation.

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

477225S: Reaction Kinetics, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ahola, Juha Lennart

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Spring period 4.

Learning outcomes:

The student is able to formulate kinetic rate equation for chemical reactions. Student is familiar with typical methods for parameter estimation and criteria for assessing the goodness of the model as well as recognize the experimental methods in chemical reaction engineering. Student is able to applied the kinetic models for analysis of chemical reactions. Contents: Formulation of material and energy balances by taking into account the effects of chemical reactions.

Contents:

Chemical reactions is gas and liquid phases. Solid catalysts and surface reactions. Empirical and mechanistic rate equations. Parameter estimation and assessing the fit of regression models. Measuring reaction rates.

Mode of delivery:

Lectures and group exercises.

Learning activities and teaching methods:

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

Target group:

Master students in Process Metallurgy, Chemical Engineering and Chemistry.

Prerequisites and co-requisites:

Calculation of thermodynamic equilibria as well as concepts related to catalysis, chemical reactions and chemical reactors as chemical engineering or physical chemistry point of view.

Recommended or required reading:

Backgroud book:
Froment G.F., Bischoff K.B. & De Wilde J (2011) Chemical Reactor Analysis and Design, John Wiley & Sons New York 900 s. ISBN-10: 0470565411, ISBN-13: 978-0470565414

Assessment methods and criteria:

Group exercise reports and an individual modelling exam.

Grading:

1 - 5, pass, fail

Person responsible:

D.Sc. Juha Ahola

780660S: Advanced water treatment chemistry, 5 op

Voimassaolo: 01.08.2018 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Chemistry

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 134 hours of work

Language of instruction:

Finnish and English

Timing:

Implementation as a net course, available in optional schedule (net tutors not available in July). Deadline for course materials created by student within 2 months from beginning. When starting course, contact anne.heponiemi@oulu.fi or sari.tuomikoski@oulu.fi to get the rights to Moodle workspace.

Learning outcomes:

After this course, student:
- knows legislation requirements and suggestions for municipal domestic water and wastewater in Finland
- knows water and wastewater treatment unit operations, chemical reactions and phenomena concerning to the treatment
- has created comprehensive dictionary regarding to municipal domestic and wastewater treatment

Contents:

Legislation concerning to the municipal domestic water and wastewater treatment and physical, chemical and biological unit operations as a treatment method. Case studies from municipal domestic water and wastewater treatment.

Mode of delivery:

Net course

Learning activities and teaching methods:

134 hours of self-study

Target group:

Chemistry, process and environmental engineering, open university, further education

Prerequisites and co-requisites:

General and inorganic chemistry A (780117P) and B (780118P) (or same knowledge).

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:

Finlex Legislation https://www.finlex.fi/en/
Letterman R.D, Water quality and treatment, fifth edition, American water works association, McGraw-Hill handbooks.
Metcalf and Eddy. Wastewater Engineering: treatment and reuse. 4. painos, Boston, McGraw-Hill, 2003.
RIL 124-1-2003 Vesihuolto I ja II, editor Karttunen E.
Scientific articles

Assessment methods and criteria:

Passing the course includes exploring to domestic and wastewater treatment technologies in Finland and the preparation of wide terminology regarding to water treatment. Course includes also the filling preliminary knowledge template and the final feedback of the course. Course work will be returned to Moodle workspace. In addition to the contents, the quality of the references and the layout of the work will be taken into account during evaluation.

Grading:

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

Person responsible:

Anne Heponiemi, Sari Tuomikoski

Working life cooperation:

No

782608S: Battery chemistries and components, 5 op

Voimassaolo: 01.01.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Chemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Ulla Lassi

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 130 hours of work

Language of instruction:

English

Timing:

The course is held in the spring semester, during the period 3. It is recommended to complete the course at the 4th or 5th spring semester.

Learning outcomes:

The student will learn the basic knowledge of the battery materials and structures. The student understands the operation principle of Li-ion battery, its structure, cell assembling. Further, student will learn how to improve the battery performances and especially, battery development from green chemistry viewpoint. The student will familiarize basics of chemistry and components in the battery system.

Contents:

Battery types and history; Lithium ion battery and principle; Anode and cathode materials used in lithium ion batteries; Electrolytes and other significant components for lithium-ion batteries; Preparation of a single battery cell, Battery cell assembling; Overview of other potential battery technologies.

Mode of delivery:

Web-based learning, Moodle learning environment.

Learning activities and teaching methods:

Lectures 40 h in the web, self-studies 90 h of which a part is done as independent work in the learning environment.

Target group:

Chemistry, chemistry teacher, process technology

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the following courses: Physical chemistry I and 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. Examination based on the lectures.

Assessment methods and criteria:

Final examination.

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:

The course includes the guest lectures from industry.

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: Saara Luhtaanmäki

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
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:
Saara Luhtaanmäki
Working life cooperation:
Yes

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:
Online 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. The exams are remote exams. It is possibility to take exams also at the university.
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:
-

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

Opettajat: Anna Kisko

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.

Target group:

Mandatory in the bachelor's stage for all students in the Mechanical Engineering Degree Program.

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:

Anna Kisko

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

ECTS Credits:

5 ETCS

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.

Target group:

Mandatory in the bachelor's stage for all students in the Mechanical Engineering Degree Programme.

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 exam and assignment/practical work or on the basis of the alternative assessment practices described at the beginning of the course.

Grading:

Numerical grading scale 1-5 / fail.

Person responsible:

Anna Kisko

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:

The course covers the stages of steel making and their effects as well as the properties of products. After completing the course, the student will know how to make modern steels, will be able to name the main types of steels and understand how their good qualities have been achieved and where development is going. In addition, he is able to explain metallurgical phenomena in heat treatment and thermomechanical treatment, and especially the techniques used to grind grain size. Environment, recyclability and CO2 emissions are an essential part of the course content.

Contents:

Production of molten steel, forging, continuous casting and rolling. Thermal and thermomechanical treatments and their effect on the properties of steels. Different types of steels, their properties and use. Environment, recyclability and emissions.

Mode of delivery:

Face to face

Learning activities and teaching methods:

Lectures 32 h / independent study and assignment / excursion; 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 work, 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. The student 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.

Target group:

Mandatory at the Bachelor stage for all students of the Materials Engineering study option of the Mechanical Engineering Degree Programme.

Recommended or required reading:

Lecture handout and other material to be reported in lectures.

Assessment methods and criteria:

The grade of the course is determined by the final exam (weight factor 0.7) and the final report (weight factor 0.3).

Grading:

Numerical grading scale 1 - 5

Person responsible:

Anna Kisko

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.

Person responsible:

Timo Kauppi

465113S: Failure mechanisms in metals, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Nousiainen, Olli Pekka

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.

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. Failures induced by hydrogen. Practical examples of failure cases.

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, 465105A Research techniques for materials, and 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:

Olli Nousiainen

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

A432236: Module of Study Option / Sustainable Energy Systems, 60 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Energy Systems

488209S: Renewable Energy, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Huuhtanen, Mika Ensio
Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 135 hours of work.

Language of instruction:

English

Timing:

Period 1

Learning outcomes:

The student is able to define different methods and techniques on renewable energy production field. The student can describe the energy production from renewable sources and is able to compare the environmental impacts of different ways of producing energy. He/she is able to identify main specific characters, challenges and driving forces in the field.

Contents:

Renewable energy production methods and technologies. Water and wind power, solar energy, biofuels, biomass conversion, side-streams utilization, power-to-X technologies, emissions and environmental aspects.

Mode of delivery:

Contact lectures

Learning activities and teaching methods:

Lectures 40h, self-study 95h

Target group:

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

Prerequisites and co-requisites:

Course 488208A Energian tuotannon ja käytön perusteet is recommended.

Recommended optional programme components:

The course is pre-requirement for 488206S Sustainable Energy Project course.

Recommended or required reading:

Materials delivered via the Moodle environment.

Assessment methods and criteria:

Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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:

This course has replaced the course 488202S Production and Use of Energy.

488507S: Energy Systems Engineering, 5 op

Voimassaolo: 01.08.2019 -
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:

Autumn, period 1

Learning outcomes:

After the course, the student is familiar with the measures and dimensions of macro-level energy production and consumption. The student will know the energy measures and able to apply correctly the units of energy. The student will gain fluency in finding, downloading, processing and visualizing energy statistics. The student will know the expectations from energy conversion and distribution systems, energy storage systems, and the management of the efficient use of energy in buildings, manufacturing, and processing systems. The student will also understand the seasonality of different energy needs and energy generation from renewable energy sources (RES) as well as will be able to calculate the required size of installations that can cover the energy needs of different targets. The student will also gain understanding of the secondary effects of energy usage from a local environmental impact, regional and national economic impact, and global climate change perspective. The student can also calculate total net energy needs, total energy from RES, % of total net energy covered by RES, total balance in primary energy units. The student can also correctly apply EROI calculations for different energy generation and storage technologies.

Contents:

The structure and domains of the power system types of power plants, transmission and distribution networks. Energy production measures and dimensions, seasonality and intermittancy. Energy measures and units, primary and secondary energy, sizing calculations for energy generation for centralized and decentralized solutions. Energy storage capacities, scales, sizing for short- and long-term options. Primary and secondary environmental impacts of energy production; land-use impacts and footprint-based calculations. EROI and net energy, footprint calculations and land-use impacts.

Mode of delivery:

Face-to-face teaching; the course has compulsory participation requirements.

Learning activities and teaching methods:

Lectures 36h; work assignment; continuous evaluation.

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:

The course is designed to be accessible to students with the broadest background. Nevertheless, a scientific and/or technical background is an advantage.

Recommended or required reading:

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

Assessment methods and criteria:

The course evaluation will be based on the grades of inrermediate tasks.

Grading:

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

Person responsible:

Prof. Eva Pongrácz

488506S: Sustainable Urban Energy, 5 op

Voimassaolo: 01.08.2018 -

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:

Period 4, on-line course

Learning outcomes:

The student can explain the concepts and legislative requirements for zero energy buildings and positive energy districts. The student will gain an understanding of the key technologies and key performance indicators (KPIs) of energy sustainable dwellings and sustainable city structures. The student will be able to calculate energy needs of buildings as well as greenhouse gas (GHG) emissions associated with energy consumption. The student can apply the psychometric chart and able to size and select suitable heating, ventilation and air conditioning (HVAC) technologies for different climate zones. The student can also apply energy modelling tools and is able to size building-integrated renewable energy technologies. The student calculate the renewable energy generation potential and make an economic assessment of the applied technologies in terms of payback time and net energy costs.

Contents:

Energy transition in cities, short and long-term strategies, features and KPIs of sustainable cities. Legislation and standards regarding building energy efficiency and urban energy; city energy planning for the 2030 and 2050 horizons. Building planning for energy efficiency, zero energy buildings, energy audits. Building integrated renewable energy generation and passive solar energy utilization. Basics of HVAC technologies ensuring indoor comfort and health. Applying the psychometric chart for different climate zones. Energy efficiency renovation, calculating energy efficiency gains and GHG reduction potential. Building skins and energy storage in the building structure. Practical examples and emerging technologies.

Mode of delivery:

On-line course, with pre-recorded video lectures, learning material and exercises. Live video conference and discussion.

Learning activities and teaching methods:

Self-learning, and self-assessment. Video lectures and tutorials for the calculation exercises. Learning tasks and calculation exercises. On-line and face-to-face consultation.

Target group:

Master's students of environmental engineering, especially of sustainable energy systems orientation; Doctoral students are also welcome to participate.

Recommended or required reading:

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

Assessment methods and criteria:

Grading of learning tasks, calculation and sizing exercises. Self-evaluation and self-assessment.

Grading:

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

Person responsible:

Prof. Eva Pongrácz

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 can explain the basic functioning of energy markets in Finland and the Nordic countries as well as the basics of electricity and carbon pricing. The student is also able to find real time data on variable energy sources (VRES) and able to apply the residual curve equation. The student can also explain the costs of large scale VRES integration and how they can be mitigated. The student can also explain demand site flexibility and the need for flexibility services emerging in the smart grid system. The student will know the expectations from smart grids and is able to outline the future perspectives of smart grid-based energy systems. The student is able to draft a scenario for the decarbonization of the energy system by 2050, and assess its economic, environmental and geopolitical implications, as well as the technological and infrastructural gaps.

Contents:

Multidisciplinary course, offered at the Faculty of Technology (Water, Energy and Environmental Engineering research group – WE3), in cooperation with 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 50 h/group work 37 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: 488202S Production and use of energy, 488504S 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, M.Sc. Mari Heikkinen, M.Sc. Hannu Huuki, M.Sc. Santtu Karhinen, M.Sc. Enni Ruokamo; CWC: Dr. Sc. 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.

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/137 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 45 h, group work 34 h.

Target group:

Master's students of environmental engineering, especially of energy systems 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:

Course 488501S Smart Grid I.

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:

Dr. Jean-Nicolas Louis
Other lecturers: Prof. Eva Pongrácz, Dr. Antonio Caló and Adeleye Adetunji.

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/150 hours of work

Language of instruction:

English

Timing:

During period 4 in spring semester

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 multiple energy networks, integrating multiple energy networks and networks flow analysis. 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 EnergyPlan freeware, 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 Smart grids 1 is a prerequisite, completing Smart grids 2 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 (EEE) and Prof. Maria Kopsakangas-Savolainen (OBS). Other lecturers: EEE: Dr. Antonio Caló, Dr. Jean-Nicolas Louis; OBS: Enni Ruokamo; CWC: 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.

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 periods 1 and 2.

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 (6 h), guided project design in small groups (30 h), individual and group work (80 h) presentations and reporting (20 h).

Target group:

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

Prerequisites and co-requisites:

The course 488209S Renewable Energy is a compulsory.
The 488203S Industrial Ecology and 477309S Process and Environmental Catalysis courses are recommended prerequisites to the project.

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 and seminar.
Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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

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 cr/135 hours of work

Language of instruction:

English

Timing:

Autumn, period 1

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 different components of a nuclear power plants and reactors. Students can also describe different elements of nuclear power technology deployment such as regulatory, safety, environmental, sustainability and health related issues.

Contents:

The first part of the course focusses primarily on the introduction of basic concepts of nuclear power production science and technology. The second part capitalizes on the information provided in the first part of the course, allowing students to fully appreciate inputs provided by guest lecturers from nuclear energy related companies, agencies and research institutes. Furthermore, during the second part of the course, students will have the possibility to test IAEA desktop simulators, providing insight and understanding of the designs as well as a better appreciation of the operational characteristics of the different reactor types. Topics discussed during the course include: basics of nuclear physics, nuclear fission and fusion; introduction to nuclear power technology and components of a nuclear power plant; history of nuclear power production; nuclear fuel cycle, uranium mining, extraction and 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; nuclear energy and international law.

Mode of delivery:

Face-to-face teaching; visiting lectures. The course has compulsory participation requirements.

Learning activities and teaching methods:

Lectures 36h;work assignment; written final exam.

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:

The course is designed to be accessible to students with the broadest background. Nevertheless, a scientific and/or technical background is an advantage.

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 evaluation will be based on the final exam.
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr. 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 doctoral students located somewhere other than Oulu to attend the course via video conference as well. Such eventuality will have to be discussed and pre-arranged with the course organizers.

Choose 20 ECTS of Following Courses

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 1 st 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.

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

488216S: Environmental Engineering Project, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Väisänen, Virpi Maria

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during 3rd and 4th periods.

Learning outcomes:

Upon completion of the course, the student is able to plan, model and implement a life cycle assessment for a product or a service following ISO 14040 and ISO 14044 standards with a life cycle assessment software.

Contents:

A project work during which a life cycle assessment for a selected product or a service is done following ISO 14040 and ISO 14044. The outcomes of the team work are reported in seminars and in a final report. In addition, there are individual assignments.

Mode of delivery:

Project work in teams, individual assignments, and seminars.

Learning activities and teaching methods:

75 h team work, 40 h individual assignments, 20 h seminars.

Target group:

Master's degree students.

Prerequisites and co-requisites:

The course 488203S Industrial Ecology is a recommended prerequisity to the project.

Recommended or required reading:

Klöpffer, W. & Grahl, B. (2014). Life Cycle Assessment (LCA) A guide to Best Practice. Wiley-VCH. 395 p. ISO standards. Software manuals.

Assessment methods and criteria:

The team exercise and individual assignments are assessed. The assessment criteria are based on the learning outcomes of the course.

Grading:

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

Person responsible:

University teacher Virpi Väisänen

Working life cooperation:

No.

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 / 135 hours of work

Language of instruction:

English

Timing:

Periods 3-4

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 and interactive course. Lectures cover the 17 goals set by the United Nations in the 2030 Agenda for Sustainable Development. The goals address the global challenges, including those related to poverty, inequality, climate change, environmental degradation, peace and justice. As an exercise, students are given a group work assignment related to sustainability reporting. The exercise is done with the support of mentors throughout the duration of the course.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 34 h, guided exercise sessions 8 h, group work 43 h and independent work 50 h.

Target group:

Master’s students of 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:

Will be provided during the course by the lecturers.

Assessment methods and criteria:

Answering learning tasks and participation in the group exercise, as well as completing the participation requirements in terms of the lectures and exercise sessions.

Grading:

The course evaluation will be based on the individual work done in the learning tasks and performace in the exercise participation and exercise report. The course unit utilizes a numerical grading scale 1-5 (accepted grades) and zero stands for a fail.

Person responsible:

University teacher Virpi Väisänen

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 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, energy issues and social sciences.

Mode of delivery:

Face-to-face teaching, video lectures and project works.

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 or individual 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 (100 %). 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:

Apulaisprofessori Hannu Marttila

Working life cooperation:

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

Other information:

Maximum number of the students in the course is 20.

477224S: Biorefineries, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S Biorefineries 3.0 op

ECTS Credits:

5 ECTS /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 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

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

782608S: Battery chemistries and components, 5 op

Voimassaolo: 01.01.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Chemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Ulla Lassi

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 130 hours of work

Language of instruction:

English

Timing:

The course is held in the spring semester, during the period 3. It is recommended to complete the course at the 4^{th} or 5^{th} spring semester.

Learning outcomes:

The student will learn the basic knowledge of the battery materials and structures. The student understands the operation principle of Li-ion battery, its structure, cell assembling. Further, student will learn how to improve the battery performances and especially, battery development from green chemistry viewpoint. The student will familiarize basics of chemistry and components in the battery system.

Contents:

Battery types and history; Lithium ion battery and principle; Anode and cathode materials used in lithium ion batteries; Electrolytes and other significant components for lithium-ion batteries; Preparation of a single battery cell, Battery cell assembling; Overview of other potential battery technologies.

Mode of delivery:

Web-based learning, Moodle learning environment.

Learning activities and teaching methods:

Lectures 40 h in the web, self-studies 90 h of which a part is done as independent work in the learning environment.

Target group:

Chemistry, chemistry teacher, process technology

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the following courses: Physical chemistry I and 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. Examination based on the lectures.

Assessment methods and criteria:

Final examination.

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:

The course includes the guest lectures from industry.

A432238: Module of Study Option / Industrial Environmental Engineering, 60 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

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:

Student recognizes the connection between catalysis and green chemistry and the role of catalysis in sustainable processes, energy production, and environmental engineering. Student is able to explain the most important industrial catalytic processes, the use of catalysts in environmental technology, and the importance of catalyst research.

Contents:

Catalyst and catalysis, sustainability. Catalysis in industry. Environmental catalysis.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 20 h, exercises 10 h, teamwork presentations 20 h, portfolio work 40 h and self-study 60 h.

Target group:

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

Prerequisites and co-requisites:

488212A Katalyysin perusteet or 488309A Biokatalyysi

Recommended or required reading:

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Assessment methods and criteria:

Portfolio and written examination

Grading:

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

Person responsible:

Satu Pitkäaho and Esa Turpeinen

Working life cooperation:

No

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 / 135 hours of work

Language of instruction:

English

Timing:

Periods 3-4

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 and interactive course. Lectures cover the 17 goals set by the United Nations in the 2030 Agenda for Sustainable Development. The goals address the global challenges, including those related to poverty, inequality, climate change, environmental degradation, peace and justice. As an exercise, students are given a group work assignment related to sustainability reporting. The exercise is done with the support of mentors throughout the duration of the course.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 34 h, guided exercise sessions 8 h, group work 43 h and independent work 50 h.

Target group:

Master's students of 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:

Will be provided during the course by the lecturers.

Assessment methods and criteria:

Answering learning tasks and participation in the group exercise, as well as completing the participation requirements in terms of the lectures and exercise sessions.

Grading:

The course evaluation will be based on the individual work done in the learning tasks and performace in the exercise participation and exercise report. 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 1 st 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.

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

488216S: Environmental Engineering Project, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Väisänen, Virpi Maria

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during 3rd and 4th periods.

Learning outcomes:

Upon completion of the course, the student is able to plan, model and implement a life cycle assessment for a product or a service following ISO 14040 and ISO 14044 standards with a life cycle assessment software.

Contents:

A project work during which a life cycle assessment for a selected product or a service is done following ISO 14040 and ISO 14044. The outcomes of the team work are reported in seminars and in a final report. In addition, there are individual assignments.

Mode of delivery:

Project work in teams, individual assignments, and seminars.

Learning activities and teaching methods:

75 h team work, 40 h individual assignments, 20 h seminars.

Target group:

Master's degree students.

Prerequisites and co-requisites:

The course 488203S Industrial Ecology is a recommended prerequisity to the project.

Recommended or required reading:

Klöpffer, W. & Grahl, B. (2014). Life Cycle Assessment (LCA) A guide to Best Practice. Wiley-VCH. 395 p. ISO standards. Software manuals.

Assessment methods and criteria:

The team exercise and individual assignments are assessed. The assessment criteria are based on the learning outcomes of the course.

Grading:

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

Person responsible:

University teacher Virpi Väisänen

Working life cooperation:

No.

488209S: Renewable Energy, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 135 hours of work.

Language of instruction:

English

Timing:

Period 1

Learning outcomes:

The student is able to define different methods and techniques on renewable energy production field. The student can describe the energy production from renewable sources and is able to compare the environmental impacts of different ways of producing energy. He/she is able to identify main specific characters, challenges and driving forces in the field.

Contents:

Renewable energy production methods and technologies. Water and wind power, solar energy, biofuels, biomass conversion, side-streams utilization, power-to-X technologies, emissions and environmental aspects.

Mode of delivery:

Contact lectures

Learning activities and teaching methods:

Lectures 40h, self-study 95h

Target group:

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

Prerequisites and co-requisites:

Course 488208A Energian tuotannon ja käytön perusteet is recommended.

Recommended optional programme components:

The course is pre-requirement for 488206S Sustainable Energy Project course.

Recommended or required reading:

Materials delivered via the Moodle environment.

Assessment methods and criteria:

Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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:

This course has replaced the course 488202S Production and Use of Energy.

488214S: Air Pollution Control Engineering - Practical Solutions, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Satu Pitkäaho

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 nd period first time in Autumn term 2020.

Learning outcomes:

Student is able to explain what kind of air emissions originate from different industrial and energy production sectors. Student deepens knowledge obtained in 488213A course and is able to apply it to different practical emission problems. She/he is able to comprehensively describe, choose, design and optimize emission control technologies. Student understands essential regulations and laws concerning emission control.

Contents:

Principles of air pollution control equipment and their use in real applications. Emission control case studies in industry and energy production sector. Air pollution related regulations and laws.

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:

488213A Ilmansuojelutekniikan perusteet

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 https://www.oulu.fi/forstudents/assesment-criteria

Grading:

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

Person responsible:

Satu Pitkäaho ja Esa Turpeinen

Working life cooperation:

No

Other information:

Replaces the course 488204S Air Pollution Control Engineering.

488215S: Industry and Environment, 5 op

Voimassaolo: 28.06.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Sanna Päivärinta-Antikainen, Väisänen, Virpi Maria
Opintokohteen kielet: English
Leikkaavuudet:

477334S Industrial activities and environment 5.0 op
ay488215S Industry and Environment (OPEN UNI) 5.0 op
488221S Environmental Load of Industry 5.0 op
488205S Environmental Load of Process Industry 4.0 op

ECTS Credits:

5 cr / 135 hours of work

Language of instruction:

English

Timing:

This course will teach first time in Autumn 2020, period 2.
This course replaces course 488221S Environmental Load of Industry.

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 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 https://www.oulu.fi/forstudents/assesment-criteria

Grading:

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

Person responsible:

Virpi Väisänen

Working life cooperation:

No.

Other information:

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

This course will teach as online course in Fitech in Spring Term 2020.

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.

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 spring semester during the 3th period. It is recommended to complete the course at the fourth (1st Master's) spring 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 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 https://www.oulu.fi/forstudents/assesment-criteria

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.

477312S: Science and Professional Ethics, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

Leikkaavuudet:

477321S	Research Ethics	3.0 op

ECTS Credits:

5 ECTS credits

Language of instruction:

English

Timing:

The course is held in Spring semester. The course is recommended to be taken during the 2nd of the M. Sc. studies. Post-graduate students are also welcomed to the course and they can, by passing this course compensate the UniOGS course on Science ethics (2 ECTS credits).

Learning outcomes:

After the course, students are familiar with the ethical codes of research, and are able to recognise and analyse ethical problems related to different fields and stages during their professional and researcher career, and in research.

Contents:

Basis for the research and professional ethics. Professional ethics. Ethical problems characteristic to the fields of technology and natural sciences. Ethical challenges and problem solving in different stages of researcher education and activities related to research. Research integrity, i.e. good scientific practice and procedures for handling misconduct and fraud in science. Ethical problems regarding the relation between scientific community and wider society.

Mode of delivery:

General ethics lectures (20 h), guest lectures (2-6 h), learning portfolio, group work and a seminar.

Learning activities and teaching methods:

Regular attendance of lectures, participation in group work and oral presentation.

Grading:

1 – 5

Person responsible:

Riitta Keiski (e-mail: firstname.lastname (at) oulu.fi)

Other information:

This Course replaces course 477321S Research Ethics (3 ECTS).

Choose 10 ECTS of Following Courses

477224S: Biorefineries, 5 op

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

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /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 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

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 https://www.oulu.fi/forstudents/assesment-criteria

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

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 periods 1 and 2.

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 (6 h), guided project design in small groups (30 h), individual and group work (80 h) presentations and reporting (20 h).

Target group:

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

Prerequisites and co-requisites:

The course 488209S Renewable Energy is a compulsory.
The 488203S Industrial Ecology and 477309S Process and Environmental Catalysis courses are recommended prerequisites to the project.

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 and seminar.
Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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

477310S: Advanced Catalytic Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

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 (next time in Autumn 2020).

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 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 https://www.oulu.fi/forstudents/assesment-criteria .

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

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: Muurinen, Esa Ilmari
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, next time 2021-22.

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 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 https://www.oulu.fi/forstudents/assesment-criteria

Grading:

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

Person responsible:

Esa Muurinen

Working life cooperation:

No

477225S: Reaction Kinetics, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ahola, Juha Lennart
Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Spring period 4.

Learning outcomes:

The student is able to formulate kinetic rate equation for chemical reactions. Student is familiar with typical methods for parameter estimation and criteria for assessing the goodness of the model as well as recognize the experimental methods in chemical reaction engineering. Student is able to applied the kinetic models for analysis of chemical reactions. Contents: Formulation of material and energy balances by taking into account the effects of chemical reactions.

Contents:

Chemical reactions is gas and liquid phases. Solid catalysts and surface reactions. Empirical and mechanistic rate equations. Parameter estimation and assessing the fit of regression models. Measuring reaction rates.

Mode of delivery:

Lectures and group exercises.

Learning activities and teaching methods:

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

Target group:

Master students in Process Metallurgy, Chemical Engineering and Chemistry.

Prerequisites and co-requisites:

Calculation of thermodynamic equilibria as well as concepts related to catalysis, chemical reactions and chemical reactors as chemical engineering or physical chemistry point of view.

Recommended or required reading:

Backgroud book:
Froment G.F., Bischoff K.B. & De Wilde J (2011) Chemical Reactor Analysis and Design, John Wiley & Sons New York 900 s. ISBN-10: 0470565411, ISBN-13: 978-0470565414

Assessment methods and criteria:

Group exercise reports and an individual modelling exam.

Grading:

1 - 5, pass, fail

Person responsible:

D.Sc. Juha Ahola

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 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, energy issues and social sciences.

Mode of delivery:

Face-to-face teaching, video lectures and project works.

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 or individual 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 (100 %). 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:

Apulaisprofessori Hannu Marttila

Working life cooperation:

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

Other information:

Maximum number of the students in the course is 20.

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 each research stage. 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, collecting experimental data, 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) Scientific research training 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 44 h.

Target group:

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

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. Materials introduced in the lectures and in Moodle.
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:

Moodle exercises (miniproject) and laboratory training.
Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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.

A432237: Module of Study Option / Hydrology and Water Management, 60 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Hydrology and Water Management

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/135 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:

Mix of guided self-study work, face-to-face teaching and field visits.

Learning activities and teaching methods:

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

Target group:

Students in master program of environmental and 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 or required reading:

Lecture hand-outs & “Lindquist, A., 2003. About water treatment. Helsingborg: Kemira Kemwater”. Optional: RIL 124-2, Vesihuolto II; Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse; AWWA, Water quality & treatment; AWWA, Water treatment plant design.

Assessment methods and criteria:

The course can be completed 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 circumstances).
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 firsthand how to deal with some of the most common issues related to water and wastewater purification systems.

Other information:

The course will be held as distance learning in the fall of 2020.

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
Fundamentals of Ground Water (F.W. Schwartz, H Zhang, 2003, ISBN 0-471-13785-5) - main book,
Physical and Chemical Hydrogeology (Domenico PA, Schwartz FW, 2nd edition, 1998, ISBN 0-471- 59762-7) – second option.
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 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

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 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

488144A: Water distribution and sewage networks, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: English

Leikkaavuudet:

488135S	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:

477052A Virtaustekniikka, Use of AutoCAD-program (488051A AutoCAD ja Matlab prosessi- ja ympäristötekniikan työkaluna or similar).

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.

Other information:

Replaces the course 488135S Water distribution and sewage networks, 5 ects.

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 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, energy issues and social sciences.

Mode of delivery:

Face-to-face teaching, video lectures and project works.

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 or individual 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 (100 %). 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:

Apulaisprofessori Hannu Marttila

Working life cooperation:

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

Other information:

Maximum number of the students in the course is 20.

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

Opettajat: Ali Torabi Haghighi

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, next time in 2021-22.

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 25 ECTS of Following Courses

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: Pertti Ala-Aho

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 (next time in Autumn 2020).

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:

Postdoctoral Researcher Pertti Ala-aho

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 3 (next time in Autumn 2020).

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 (next time in Autumn 2020).

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 https://www.oulu.fi/forstudents/assesment-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 is given every second spring semester (2021, 2023, 2025, etc) during period 4.

Learning outcomes:

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

Contents:

Grid-based numerical modelling, solute transport, model uncertainties, groundwater management

Mode of delivery:

Contact teaching in lectures and practical modeling sessions. Independent work on return assignment and seminar project. Option for online course participation if unable to attend in person due to compelling reasons.

Learning activities and teaching methods:

Lectures (12 h), modelling work (48 h) and self-study and report (75 h).

Target group:

Master students in the water engineering orientation of the Hydrology and Water management 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.

Recommended or required reading:

Fundamentals of Groundwater (Schwartz and Zhang 2002 ISBN: 978-0-471-13785-6), lecture material

Assessment methods and criteria:

Modelling assignments, and project work with report and presentation.

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.

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:

Course 485306S replaces this course in academic year 2019-2020.

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:

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Recommended or required reading:

Handout and other materials delivered in lectures

Assessment methods and criteria:

Written exam and exercises
Read more about assessment criteria at the University of Oulu webpage.

Grading:

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

Person responsible:

University teacher Anne Tuomela

Working life cooperation:

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

Other information:

-

488145S: Data analysis for Water Resources, 5 op

Voimassaolo: 01.01.2020 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannu Marttila

Opintokohteen kielet: English

Leikkaavuudet:

488137S	Statistical hydrology	5.0 op

Ei opintojaksokuvauksia.

488146S: Urban water management, 5 op

Voimassaolo: 01.01.2020 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Pekka Rossi
Opintokohteen kielet: English
Leikkaavuudet:

488141S	Urban hydrology	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:

AutoCAD ja Matlab prosessi- ja ympäristötekniikan työkaluna or at least equivalent information about CAD use .477052A Fluid mechanics, 477312A Lämmön- ja aineensiirto and 488102A Hydrological Processes.

Recommended optional programme components:

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

Recommended or required reading:

Lecture handouts and materials, 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.

Other information:

This course replaces the course 488141S Urban hydrology.

A433246: Process and Environmental Engineering / Supplementary Module, Industrial Engineering, 30 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Industrial Engineering

555285A: Project management, 5 op

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

555288A Project Management 5.0 op

ay555285A Project management (OPEN UNI) 5.0 op

555282A Project Management 4.0 op

555280P Basic Course of Project Management 2.0 op

ECTS Credits:

5 ECTS credits.

Language of instruction:

Finnish. Check the course in English 555288A Project Management.

Timing:

Period 2.

Learning outcomes:

Upon completion of the course, the student will be able to:

- describe explain the essential concepts and methods related to project management
- apply project management methods to create a schedule for a project and calculate critical path

- understand essential concepts related to project cost management and able to apply earned value method and three point estimate to manage project costs
- recognises the essential tasks of project risk management

Contents:

Defining project management, project goals and objectives, project phases and project life-cycle management, project planning, organising and scope management, schedule management, cost management, earned value calculation and project risk management, project stakeholder management, project communications management, the role of project manager, new modes of project delivery

Mode of delivery:

The tuition will be implemented as web-based teaching.

Learning activities and teaching methods:

Web-based lectures 16h, self-study 118h

Target group:

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

Prerequisites and co-requisites:

No prerequisites exist.

Recommended optional programme components:

This course is part of the 25 ECTS module of Industrial engineering and management that also includes555225P Basics of industrial engineering and management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

Recommended or required reading:

Lecture material, exercise book, Artto, Martinsuo & Kujala 2006. Projektiliiketoiminta. WSOY

Assessment methods and criteria:

Weekly assignments and final online exam

Grading:

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

Person responsible:

Assistant professor Kirsi Aaltonen

Working life cooperation:

Videos from the industry’s projects

Other information:

Substitutes courses 555280P Basic Course of Project Management + 555282A Project Management.

555242A: Product development, 5 op

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Haapasalo, Harri Jouni Olavi

Opintokohteen kielet: English

Leikkaavuudet:

ay555242A Product development (OPEN UNI) 5.0 op

555240A Basic Course in Product Development 3.0 op

ECTS Credits:

5 ECTS credits**.**

Language of instruction:

English.

Timing:

Periods 1-2.

Learning outcomes:

This course introduces product development and innovations management in a company environment. The course provides fundamental understanding over tools and frameworks that can be used for analysing and managing products, innovations, and technology development. The aim is to create a connection between product development and other company functions. Upon completion of the course, the student will be able to

- explain the role of product development as a company function
- understand the difference between innovation activities and systematic product development, and knows the difference between different phases of product development process and its activities
- transform customer needs into requirements for product development process and finally into product features
- define the meaning of other company functions to product development activities

Contents:

Meaning of products for the operations of an industrial enterprise, product development paradigm and defining relevant concepts, realising product development methodologically (U&E model, Cooper's stage-gate model, QFD), managing innovations, and product development success factors.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 20 h / exercises 6 h / group work and self-study 108 h.

Target group:

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

Prerequisites and co-requisites:

555226A Operations and supply chain management (Operations and production)

Recommended optional programme components:

This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555285A Project management, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

Recommended or required reading:

Handouts, course work, and a collection of articles. Ulrich, K. & Eppinger, S. (2008) Product Design and Development. McGraw-Hill. 358 p.

Assessment methods and criteria:

Exam and group work.

Grading:

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

Person responsible:

Professor Harri Haapasalo.

Working life cooperation:

No.

Other information:

Substitutes course 555240A Basic Course in Product Development.

555226A: Operations and supply chain management, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Farzad Pargar

Opintokohteen kielet: English

Leikkaavuudet:

555222A	Demonstration in Industrial Engineering and Management	2.0 op
555223A	Introduction to Production Control	3.0 op

ECTS Credits:

5 ECTS credits

Language of instruction:

English.

Timing:

Periods 1-2.

Learning outcomes:

Upon completion of the course, the student will be able to:

- describe different production types
- apply different forecasting methods, plan needed production capacity, and apply location and transportation decisions related methods
- master common inventory management methods and aggregated and short-term scheduling
- create a sales and operations plan for a company

Contents:

Production types, forecasting methods, capacity planning and queuing models, location and transportation decisions, inventory management systems, aggregate scheduling, MRP & ERP, short-term scheduling, linear programming.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 16 hours / independent studying 64 hours.

Target group:

Industrial Engineering and Management students.

Prerequisites and co-requisites:

555225P Basics of industrial engineering and management or similar knowledge.

Recommended optional programme components:

Industrial Engineering and Management students will complete 902143Y Company presentations course simultaneously.

Recommended or required reading:

Lecture and exercise materials. Krajewski, L.J. et al. (2012) Operations management: processes and supply chains, 10th ed. Pearson. In addition, recommended material includes chapter 13 in Heizer, J. & Render, B. (2014) Operations management: sustainability and supply chain management, 11th ed. Pearson.

Assessment methods and criteria:

This course utilises continuous assessment. During the course, there are mandatory weekly assignments. At least half of the assignments must be passed. 40 % of the grade is based on the group work.

Grading:

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

Person responsible:

Post-doctoral researcher Farzad Pargar.

Working life cooperation:

The group work will be done for a real company by using public information sources.

Other information:

Substitutes course 555222A Demonstration in Industrial Engineering and Management 2 ECTS cr and 555223A Introduction to Production Control 3 ECTS cr.
Previous course name was 'Operations and Production'.

555286A: Process and quality management, 5 op

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Osmo Kauppila

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay555286A	Process and quality management (OPEN UNI)	5.0 op
555281A	Basic Course of Quality Management	5.0 op

ECTS Credits:

5 ECTS credits.

Language of instruction:

Finnish.

Timing:

Period 4.

Learning outcomes:

Upon completion of the course, the student will be able to:
- explain the role of process and quality management in a business organisation
- develop business processes based on the principles of quality management and appropriate tool

Contents:

Foundations of total quality management, planning of quality, performance measurement, process management, people management in relation to quality management, implantation of total quality management.

Mode of delivery:

The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:

20 h lectures, 114 h independent study

Target group:

Industrial Engineering and Management students and other students studying Industrial Engineering and Management as minor.

Prerequisites and co-requisites:

-

Recommended optional programme components:

This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555285A Project management, 555242A Product development, and 555264P Managing well-being and quality of working life.

Recommended or required reading:

Oakland, J.S. (2014) Total quality management and operational excellence (4th ed.). Routledge, 529 pp. and material handed out during the course.

Assessment methods and criteria:

To pass the course, the student must pass the weekly course exercises (50 % of the course grade) and an exam (50 %).

Grading:

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

Person responsible:

University lecturer Osmo Kauppila.

Working life cooperation:

No.

Other information:

Substitutes course 555281A Basic Course of Quality Management.

555390S: Process Analytics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Osmo Kauppila

Opintokohteen kielet: Finnish

Leikkaavuudet:

555380S	Quality Management	5.0 op

ECTS Credits:

5 ECTS credits.

Language of instruction:

Finnish.

Timing:

Period 1.

Learning outcomes:

Upon completion of the course, the student will be able to:

- analyse and improve the processes of an organisation with the help of statistical tools
- disseminate the applicability of various statistical tools and methods in different kinds of organisational environments

Contents:

Processes in an organization from a statistical viewpoint, tools and methods of statistical process control, process improvement using numeric data, stages, challenges and implementation of data analysis, the role of statistical methods in various management philosophies.

Mode of delivery:

The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:

28 h lectures, 106 h independent study on course exercises.

Target group:

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

Prerequisites and co-requisites:

555286A Process and Quality Management

Recommended optional programme components:

-

Recommended or required reading:

Foreman, J. (2014) Data smart: using data science to transform information into insight. Wiley & Sons: Indianapolis. Other material handed out during the course.

Assessment methods and criteria:

To pass the course, the student must complete the course exercises. The course grade is determined by the completeness and independent thought demonstrated in the set of exercises.

Grading:

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

Person responsible:

University lecturer Osmo Kauppila.

Working life cooperation:

No.

Other information:

Substitutes course 555380S Quality Management.

555389S: Systematic Process Improvement, 10 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Osmo Kauppila

Opintokohteen kielet: Finnish

ECTS Credits:

10 ECTS credits.

Language of instruction:

Finnish

Timing:

Periods 1 - 2

Learning outcomes:

Upon completion of the course, the student will be able to:

- manage the improvement and problem solving in a process using quality management tools
- explain the steps of the DMAIC problem solving model and apply the correct tools for each step
- apply quality tools into real life process data with the help of MINITAB software and to analyse the results
- increase his/her understanding of the process type studied in the course exercise

Contents:

Problem solving using DMAIC, the Six Sigma body of knowledge quality tools, use of MINITAB software, process improvement in practice.

Mode of delivery:

The tuition will be implemented as blended teaching.

Learning activities and teaching methods:

Lectures and related exercises, site visit, a large group exercise related to a process operating in practice.

Target group:

Industrial Engineering and Management students, other students taking Industrial Engineering and Management as minor, postgraduate students.

Prerequisites and co-requisites:

Bachelor in Industrial Engineering and Management or equivalent. Basic knowledge of statistical process control.

Recommended optional programme components:

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Recommended or required reading:

Kubiak, TM & Benbow DW (2009) The Certified Six Sigma Black Belt Handbook, Second Edition. ASQ Quality Press, Milwaukee. 620 s. and material handed out during the course.

Assessment methods and criteria:

To pass the course, the student must complete the group work as an active team member (50 % of the course grade), take part in the course lectures and return the related exercises (50 %).

Grading:

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

Person responsible:

University lecturer Osmo Kauppila.

Working life cooperation:

a group exercise related to a process operating in practice.

Other information:

-

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

ECTS Credits:
0 ECTS
Language of instruction:
Finnish, Swedish or English.
Timing:
After completion of the master's thesis.
Learning outcomes:
The student can produce text in popular form of the research field and thus show ones familiarity to the field.
Contents:
Depends on the topic of the thesis.
Mode of delivery:
Literary work.
Learning activities and teaching methods:
Exam.
Target group:
Master Students of Process Engineering
Recommended or required reading:
Will be written after the Master's Thesis has been submitted for review.
Assessment methods and criteria:
Student writes an essay about the topic of the Master's thesis to show a good command of the content of the thesis.
Read more about the assesments criteria at https://www.oulu.fi/forstudents/assesment-criteria .
Grading:
Pass or fail
Person responsible:
Supervisor of Thesis

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

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:

Examination. The course can be completed with three 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 https://www.oulu.fi/forstudents/assesment-criteria.

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

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' and 'Material and Energy Balances' 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.

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 24 h, exercises 16 h and independent work 93 h. Totally 133 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:

Online teaching, Stack/Moodle digital learning environment

Learning activities and teaching methods:

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

Target group:

1. year students of engineering, 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:

Recommended 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:

No

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: Pauliina Uusitalo

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:

Online 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:

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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. The exams are remote exams. It is possibility to take exams also at the university.
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:

Pauliina Uusitalo

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:

-

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: Marja Mikola

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 about 30 h, exercises about 10 h and self-study about 90 h.

Target group:

Bachelor students in process and environmental engineering, minor subject students

Prerequisites and co-requisites:

Objectives of Material and Energy Balances and Thermodynamic Equilibrium

Recommended optional programme components:

-

Recommended or required reading:

Lecture handouts
Levenspiel, O.: Chemical Reaction Engineering. John Wiley & Sons, 1972. or newer (parts)
Atkins, P.W.: Physical Chemistry, Oxford University Press, 2002. 7. edition or newer (parts)

Assessment methods and criteria:

Two midterm exams during the course, which can be replaced with final exam after the course and two exercises.

Grading:

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

Person responsible:

Marja Mikola

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. 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., Okiishi, T.H., Huebsch W.W. & Rothmayer A.P. Fluid Mechanics, 7. painos, Wiley 2013. ISBN 978-1-118-318676
or
Gerhart, Gerhart, Hochstein 2017. Munson's Fluid Mechanics. ISBN 978-1-119-24898-9.

Assessment methods and criteria:

This course utilizes continuous assessment. During the course there are 3 intermediate exams in Finnish. 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

477323A: Mass and Heat Transfer, 5 op

Voimassaolo: 01.08.2019 -

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:

477322A Heat and Mass Transfer 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 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:

Welty J.R., Rorrer G.L. & Foster D.G. Fundamentals of Momentum, Heat and Mass Transfer, International student version, 6. painos, Wiley 2015,ISBN 978-1-118-80887-0, parts 14-28.

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:

Replaces the course 477322A Lämmön ja aineensiirto, 5 ects.

477221A: Material and Energy Balances, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Marja Mikola

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay477231A	Material and Energy Balances I (OPEN UNI)	2.0 op
ay477232A	Material and Energy Balances II (OPEN UNI)	3.0 op
ay477221A	Material and Energy Balances (OPEN UNI)	5.0 op
477201A	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. Multiunit cases are also considered.

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, minor subject students in relevant disciplines.

Prerequisites and co-requisites:

High school level chemistry, mathematics and physics.

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:

Reklaitis, G.V.: Introduction to Material and Energy Balances. John Wiley & Sons, 1983. ISBN 0-471-041319.

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.

Person responsible:

Juha Ahola

Other information:

This course replaces the course 477201A Material and Energy Balances, 5 ects.

A432236: Module of Study Option / Sustainable Energy Systems, 60 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Energy Systems

488209S: Renewable Energy, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 135 hours of work.

Language of instruction:

English

Timing:

Period 1

Learning outcomes:

The student is able to define different methods and techniques on renewable energy production field. The student can describe the energy production from renewable sources and is able to compare the environmental impacts of different ways of producing energy. He/she is able to identify main specific characters, challenges and driving forces in the field.

Contents:

Renewable energy production methods and technologies. Water and wind power, solar energy, biofuels, biomass conversion, side-streams utilization, power-to-X technologies, emissions and environmental aspects.

Mode of delivery:

Contact lectures

Learning activities and teaching methods:

Lectures 40h, self-study 95h

Target group:

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

Prerequisites and co-requisites:

Course 488208A Energian tuotannon ja käytön perusteet is recommended.

Recommended optional programme components:

The course is pre-requirement for 488206S Sustainable Energy Project course.

Recommended or required reading:

Materials delivered via the Moodle environment.

Assessment methods and criteria:

Written final exam.
Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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:

This course has replaced the course 488202S Production and Use of Energy.

488507S: Energy Systems Engineering, 5 op

Voimassaolo: 01.08.2019 -

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:

Autumn, period 1

Learning outcomes:

After the course, the student is familiar with the measures and dimensions of macro-level energy production and consumption. The student will know the energy measures and able to apply correctly the units of energy. The student will gain fluency in finding, downloading, processing and visualizing energy statistics. The student will know the expectations from energy conversion and distribution systems, energy storage systems, and the management of the efficient use of energy in buildings, manufacturing, and processing systems. The student will also understand the seasonality of different energy needs and energy generation from renewable energy sources (RES) as well as will be able to calculate the required size of installations that can cover the energy needs of different targets. The student will also gain understanding of the secondary effects of energy usage from a local environmental impact, regional and national economic impact, and global climate change perspective. The student can also calculate total net energy needs, total energy from RES, % of total net energy covered by RES, total balance in primary energy units. The student can also correctly apply EROI calculations for different energy generation and storage technologies.

Contents:

The structure and domains of the power system types of power plants, transmission and distribution networks. Energy production measures and dimensions, seasonality and intermittancy. Energy measures and units, primary and secondary energy, sizing calculations for energy generation for centralized and decentralized solutions. Energy storage capacities, scales, sizing for short- and long-term options. Primary and secondary environmental impacts of energy production; land-use impacts and footprint-based calculations. EROI and net energy, footprint calculations and land-use impacts.

Mode of delivery:

Face-to-face teaching; the course has compulsory participation requirements.

Learning activities and teaching methods:

Lectures 36h; work assignment; continuous evaluation.

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:

The course is designed to be accessible to students with the broadest background. Nevertheless, a scientific and/or technical background is an advantage.

Recommended or required reading:

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

Assessment methods and criteria:

The course evaluation will be based on the grades of inrermediate tasks.

Grading:

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

Person responsible:

Prof. Eva Pongrácz

488506S: Sustainable Urban Energy, 5 op

Voimassaolo: 01.08.2018 -

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:

Period 4, on-line course

Learning outcomes:

The student can explain the concepts and legislative requirements for zero energy buildings and positive energy districts. The student will gain an understanding of the key technologies and key performance indicators (KPIs) of energy sustainable dwellings and sustainable city structures. The student will be able to calculate energy needs of buildings as well as greenhouse gas (GHG) emissions associated with energy consumption. The student can apply the psychometric chart and able to size and select suitable heating, ventilation and air conditioning (HVAC) technologies for different climate zones. The student can also apply energy modelling tools and is able to size building-integrated renewable energy technologies. The student calculate the renewable energy generation potential and make an economic assessment of the applied technologies in terms of payback time and net energy costs.

Contents:

Energy transition in cities, short and long-term strategies, features and KPIs of sustainable cities. Legislation and standards regarding building energy efficiency and urban energy; city energy planning for the 2030 and 2050 horizons. Building planning for energy efficiency, zero energy buildings, energy audits. Building integrated renewable energy generation and passive solar energy utilization. Basics of HVAC technologies ensuring indoor comfort and health. Applying the psychometric chart for different climate zones. Energy efficiency renovation, calculating energy efficiency gains and GHG reduction potential. Building skins and energy storage in the building structure. Practical examples and emerging technologies.

Mode of delivery:

On-line course, with pre-recorded video lectures, learning material and exercises. Live video conference and discussion.

Learning activities and teaching methods:

Self-learning, and self-assessment. Video lectures and tutorials for the calculation exercises. Learning tasks and calculation exercises. On-line and face-to-face consultation.

Target group:

Master's students of environmental engineering, especially of sustainable energy systems orientation; Doctoral students are also welcome to participate.

Recommended or required reading:

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

Assessment methods and criteria:

Grading of learning tasks, calculation and sizing exercises. Self-evaluation and self-assessment.

Grading:

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

Person responsible:

Prof. Eva Pongrácz

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 can explain the basic functioning of energy markets in Finland and the Nordic countries as well as the basics of electricity and carbon pricing. The student is also able to find real time data on variable energy sources (VRES) and able to apply the residual curve equation. The student can also explain the costs of large scale VRES integration and how they can be mitigated. The student can also explain demand site flexibility and the need for flexibility services emerging in the smart grid system. The student will know the expectations from smart grids and is able to outline the future perspectives of smart grid-based energy systems. The student is able to draft a scenario for the decarbonization of the energy system by 2050, and assess its economic, environmental and geopolitical implications, as well as the technological and infrastructural gaps.

Contents:

Multidisciplinary course, offered at the Faculty of Technology (Water, Energy and Environmental Engineering research group – WE3), in cooperation with 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 50 h/group work 37 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: 488202S Production and use of energy, 488504S 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, M.Sc. Mari Heikkinen, M.Sc. Hannu Huuki, M.Sc. Santtu Karhinen, M.Sc. Enni Ruokamo; CWC: Dr. Sc. 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.

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/137 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 45 h, group work 34 h.

Target group:

Master's students of environmental engineering, especially of energy systems 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:

Course 488501S Smart Grid I.

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:

Dr. Jean-Nicolas Louis
Other lecturers: Prof. Eva Pongrácz, Dr. Antonio Caló and Adeleye Adetunji.

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/150 hours of work

Language of instruction:

English

Timing:

During period 4 in spring semester

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 multiple energy networks, integrating multiple energy networks and networks flow analysis. 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 EnergyPlan freeware, 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 Smart grids 1 is a prerequisite, completing Smart grids 2 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 (EEE) and Prof. Maria Kopsakangas-Savolainen (OBS). Other lecturers: EEE: Dr. Antonio Caló, Dr. Jean-Nicolas Louis; OBS: Enni Ruokamo; CWC: 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.

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 periods 1 and 2.

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 (6 h), guided project design in small groups (30 h), individual and group work (80 h) presentations and reporting (20 h).

Target group:

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

Prerequisites and co-requisites:

The course 488209S Renewable Energy is a compulsory.
The 488203S Industrial Ecology and 477309S Process and Environmental Catalysis courses are recommended prerequisites to the project.

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 and seminar.
Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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

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 cr/135 hours of work

Language of instruction:

English

Timing:

Autumn, period 1

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 different components of a nuclear power plants and reactors. Students can also describe different elements of nuclear power technology deployment such as regulatory, safety, environmental, sustainability and health related issues.

Contents:

The first part of the course focusses primarily on the introduction of basic concepts of nuclear power production science and technology. The second part capitalizes on the information provided in the first part of the course, allowing students to fully appreciate inputs provided by guest lecturers from nuclear energy related companies, agencies and research institutes. Furthermore, during the second part of the course, students will have the possibility to test IAEA desktop simulators, providing insight and understanding of the designs as well as a better appreciation of the operational characteristics of the different reactor types. Topics discussed during the course include: basics of nuclear physics, nuclear fission and fusion; introduction to nuclear power technology and components of a nuclear power plant; history of nuclear power production; nuclear fuel cycle, uranium mining, extraction and 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; nuclear energy and international law.

Mode of delivery:

Face-to-face teaching; visiting lectures. The course has compulsory participation requirements.

Learning activities and teaching methods:

Lectures 36h;work assignment; written final exam.

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:

The course is designed to be accessible to students with the broadest background. Nevertheless, a scientific and/or technical background is an advantage.

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 evaluation will be based on the final exam.
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr. 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 doctoral students located somewhere other than Oulu to attend the course via video conference as well. Such eventuality will have to be discussed and pre-arranged with the course organizers.

Choose 20 ECTS of Following Courses

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 1 st 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.

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.](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

488216S: Environmental Engineering Project, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Väisänen, Virpi Maria

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during 3rd and 4th periods.

Learning outcomes:

Upon completion of the course, the student is able to plan, model and implement a life cycle assessment for a product or a service following ISO 14040 and ISO 14044 standards with a life cycle assessment software.

Contents:

A project work during which a life cycle assessment for a selected product or a service is done following ISO 14040 and ISO 14044. The outcomes of the team work are reported in seminars and in a final report. In addition, there are individual assignments.

Mode of delivery:

Project work in teams, individual assignments, and seminars.

Learning activities and teaching methods:

75 h team work, 40 h individual assignments, 20 h seminars.

Target group:

Master's degree students.

Prerequisites and co-requisites:

The course 488203S Industrial Ecology is a recommended prerequisity to the project.

Recommended or required reading:

Klöpffer, W. & Grahl, B. (2014). Life Cycle Assessment (LCA) A guide to Best Practice. Wiley-VCH. 395 p. ISO standards. Software manuals.

Assessment methods and criteria:

The team exercise and individual assignments are assessed. The assessment criteria are based on the learning outcomes of the course.

Grading:

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

Person responsible:

University teacher Virpi Väisänen

Working life cooperation:

No.

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 / 135 hours of work

Language of instruction:

English

Timing:

Periods 3-4

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 and interactive course. Lectures cover the 17 goals set by the United Nations in the 2030 Agenda for Sustainable Development. The goals address the global challenges, including those related to poverty, inequality, climate change, environmental degradation, peace and justice. As an exercise, students are given a group work assignment related to sustainability reporting. The exercise is done with the support of mentors throughout the duration of the course.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 34 h, guided exercise sessions 8 h, group work 43 h and independent work 50 h.

Target group:

Master's students of 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:

Will be provided during the course by the lecturers.

Assessment methods and criteria:

Answering learning tasks and participation in the group exercise, as well as completing the participation requirements in terms of the lectures and exercise sessions.

Grading:

The course evaluation will be based on the individual work done in the learning tasks and performace in the exercise participation and exercise report. The course unit utilizes a numerical grading scale 1-5 (accepted grades) and zero stands for a fail.

Person responsible:

University teacher Virpi Väisänen

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 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, energy issues and social sciences.

Mode of delivery:

Face-to-face teaching, video lectures and project works.

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 or individual 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 (100 %). 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:

Apulaisprofessori Hannu Marttila

Working life cooperation:

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

Other information:

Maximum number of the students in the course is 20.

477224S: Biorefineries, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /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 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

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

782608S: Battery chemistries and components, 5 op

Voimassaolo: 01.01.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Chemistry
Arvostelu: 1 - 5, pass, fail
Opettajat: Ulla Lassi
Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 130 hours of work

Language of instruction:

English

Timing:

The course is held in the spring semester, during the period 3. It is recommended to complete the course at the 4^{th} or 5^{th} spring semester.

Learning outcomes:

The student will learn the basic knowledge of the battery materials and structures. The student understands the operation principle of Li-ion battery, its structure, cell assembling. Further, student will learn how to improve the battery performances and especially, battery development from green chemistry viewpoint. The student will familiarize basics of chemistry and components in the battery system.

Contents:

Battery types and history; Lithium ion battery and principle; Anode and cathode materials used in lithium ion batteries; Electrolytes and other significant components for lithium-ion batteries; Preparation of a single battery cell, Battery cell assembling; Overview of other potential battery technologies.

Mode of delivery:

Web-based learning, Moodle learning environment.

Learning activities and teaching methods:

Lectures 40 h in the web, self-studies 90 h of which a part is done as independent work in the learning environment.

Target group:

Chemistry, chemistry teacher, process technology

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the following courses: Physical chemistry I and 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. Examination based on the lectures.

Assessment methods and criteria:

Final examination.

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:

The course includes the guest lectures from industry.

A432238: Module of Study Option / Industrial Environmental Engineering, 60 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Industrial Environmental Engineering

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:

Student recognizes the connection between catalysis and green chemistry and the role of catalysis in sustainable processes, energy production, and environmental engineering. Student is able to explain the most important industrial catalytic processes, the use of catalysts in environmental technology, and the importance of catalyst research.

Contents:

Catalyst and catalysis, sustainability. Catalysis in industry. Environmental catalysis.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 20 h, exercises 10 h, teamwork presentations 20 h, portfolio work 40 h and self-study 60 h.

Target group:

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

Prerequisites and co-requisites:

488212A Katalyysin perusteet or 488309A Biokatalyysi

Recommended or required reading:

-

Assessment methods and criteria:

Portfolio and written examination

Grading:

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

Person responsible:

Satu Pitkäaho and Esa Turpeinen

Working life cooperation:

No

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 / 135 hours of work

Language of instruction:

English

Timing:

Periods 3-4

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 and interactive course. Lectures cover the 17 goals set by the United Nations in the 2030 Agenda for Sustainable Development. The goals address the global challenges, including those related to poverty, inequality, climate change, environmental degradation, peace and justice. As an exercise, students are given a group work assignment related to sustainability reporting. The exercise is done with the support of mentors throughout the duration of the course.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 34 h, guided exercise sessions 8 h, group work 43 h and independent work 50 h.

Target group:

Master’s students of 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:

Will be provided during the course by the lecturers.

Assessment methods and criteria:

Answering learning tasks and participation in the group exercise, as well as completing the participation requirements in terms of the lectures and exercise sessions.

Grading:

The course evaluation will be based on the individual work done in the learning tasks and performace in the exercise participation and exercise report. 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 1 st 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.

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

488216S: Environmental Engineering Project, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Väisänen, Virpi Maria

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

English

Timing:

Implementation in spring semester during 3rd and 4th periods.

Learning outcomes:

Upon completion of the course, the student is able to plan, model and implement a life cycle assessment for a product or a service following ISO 14040 and ISO 14044 standards with a life cycle assessment software.

Contents:

A project work during which a life cycle assessment for a selected product or a service is done following ISO 14040 and ISO 14044. The outcomes of the team work are reported in seminars and in a final report. In addition, there are individual assignments.

Mode of delivery:

Project work in teams, individual assignments, and seminars.

Learning activities and teaching methods:

75 h team work, 40 h individual assignments, 20 h seminars.

Target group:

Master's degree students.

Prerequisites and co-requisites:

The course 488203S Industrial Ecology is a recommended prerequisity to the project.

Recommended or required reading:

Klöpffer, W. & Grahl, B. (2014). Life Cycle Assessment (LCA) A guide to Best Practice. Wiley-VCH. 395 p.
ISO standards. Software manuals.

Assessment methods and criteria:

The team exercise and individual assignments are assessed. The assessment criteria are based on the learning outcomes of the course.

Grading:

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

Person responsible:

University teacher Virpi Väisänen

Working life cooperation:

No.

488209S: Renewable Energy, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 135 hours of work.

Language of instruction:

English

Timing:

Period 1

Learning outcomes:

The student is able to define different methods and techniques on renewable energy production field. The student can describe the energy production from renewable sources and is able to compare the environmental impacts of different ways of producing energy. He/she is able to identify main specific characters, challenges and driving forces in the field.

Contents:

Renewable energy production methods and technologies. Water and wind power, solar energy, biofuels, biomass conversion, side-streams utilization, power-to-X technologies, emissions and environmental aspects.

Mode of delivery:

Contact lectures

Learning activities and teaching methods:

Lectures 40h, self-study 95h

Target group:

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

Prerequisites and co-requisites:

Course 488208A Energian tuotannon ja käytön perusteet is recommended.

Recommended optional programme components:

The course is pre-requirement for 488206S Sustainable Energy Project course.

Recommended or required reading:

Materials delivered via the Moodle environment.

Assessment methods and criteria:

Written final exam.

Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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:

This course has replaced the course 488202S Production and Use of Energy.

488214S: Air Pollution Control Engineering - Practical Solutions, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Satu Pitkäaho

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

English

Timing:

Implementation in autumn semester during 2 nd period first time in Autumn term 2020.

Learning outcomes:

Student is able to explain what kind of air emissions originate from different industrial and energy production sectors. Student deepens knowledge obtained in 488213A course and is able to apply it to different practical emission problems. She/he is able to comprehensively describe, choose, design and optimize emission control technologies. Student understands essential regulations and laws concerning emission control.

Contents:

Principles of air pollution control equipment and their use in real applications. Emission control case studies in industry and energy production sector. Air pollution related regulations and laws.

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:

488213A Ilmansuojelutekniikan perusteet

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 https://www.oulu.fi/forstudents/assesment-criteria

Grading:

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

Person responsible:

Satu Pitkäaho ja Esa Turpeinen

Working life cooperation:

No

Other information:

Replaces the course 488204S Air Pollution Control Engineering.

488215S: Industry and Environment, 5 op

Voimassaolo: 28.06.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Sanna Päivärinta-Antikainen, Väisänen, Virpi Maria

Opintokohteen kielet: English

Leikkaavuudet:

477334S	Industrial activities and environment	5.0 op
ay488215S	Industry and Environment (OPEN UNI)	5.0 op
488221S	Environmental Load of Industry	5.0 op
488205S	Environmental Load of Process Industry	4.0 op

ECTS Credits:

5 cr / 135 hours of work

Language of instruction:

English

Timing:

This course will teach first time in Autumn 2020, period 2.
This course replaces course 488221S Environmental Load of Industry.

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 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 https://www.oulu.fi/forstudents/assesment-criteria

Grading:

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

Person responsible:

Virpi Väisänen

Working life cooperation:

No.

Other information:

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

This course will teach as online course in Fitech in Spring Term 2020.

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.

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:

-

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 spring semester during the 3th period. It is recommended to complete the course at the fourth (1st Master's) spring 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 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 https://www.oulu.fi/forstudents/assesment-criteria

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.

477312S: Science and Professional Ethics, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

Leikkaavuudet:

477321S	Research Ethics	3.0 op

ECTS Credits:

5 ECTS credits

Language of instruction:

English

Timing:

The course is held in Spring semester. The course is recommended to be taken during the 2nd of the M. Sc. studies. Post-graduate students are also welcomed to the course and they can, by passing this course compensate the UniOGS course on Science ethics (2 ECTS credits).

Learning outcomes:

After the course, students are familiar with the ethical codes of research, and are able to recognise and analyse ethical problems related to different fields and stages during their professional and researcher career, and in research.

Contents:

Basis for the research and professional ethics. Professional ethics. Ethical problems characteristic to the fields of technology and natural sciences. Ethical challenges and problem solving in different stages of researcher education and activities related to research. Research integrity, i.e. good scientific practice and procedures for handling misconduct and fraud in science. Ethical problems regarding the relation between scientific community and wider society.

Mode of delivery:

General ethics lectures (20 h), guest lectures (2-6 h), learning portfolio, group work and a seminar.

Learning activities and teaching methods:

Regular attendance of lectures, participation in group work and oral presentation.

Grading:

1 – 5

Person responsible:

Riitta Keiski (e-mail: firstname.lastname (at) oulu.fi)

Other information:

This Course replaces course 477321S Research Ethics (3 ECTS).

Choose 10 ECTS of Following Courses

477224S: Biorefineries, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /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 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

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 https://www.oulu.fi/forstudents/assesment-criteria

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

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 periods 1 and 2.

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 (6 h), guided project design in small groups (30 h), individual and group work (80 h) presentations and reporting (20 h).

Target group:

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

Prerequisites and co-requisites:

The course 488209S Renewable Energy is a compulsory.
The 488203S Industrial Ecology and 477309S Process and Environmental Catalysis courses are recommended prerequisites to the project.

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 and seminar.
Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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

477310S: Advanced Catalytic Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

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 (next time in Autumn 2020).

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 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 https://www.oulu.fi/forstudents/assesment-criteria .

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

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: Muurinen, Esa Ilmari

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, next time 2021-22.

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 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 https://www.oulu.fi/forstudents/assesment-criteria

Grading:

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

Person responsible:

Esa Muurinen

Working life cooperation:

No

477225S: Reaction Kinetics, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ahola, Juha Lennart

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Spring period 4.

Learning outcomes:

The student is able to formulate kinetic rate equation for chemical reactions. Student is familiar with typical methods for parameter estimation and criteria for assessing the goodness of the model as well as recognize the experimental methods in chemical reaction engineering. Student is able to applied the kinetic models for analysis of chemical reactions. Contents: Formulation of material and energy balances by taking into account the effects of chemical reactions.

Contents:

Chemical reactions is gas and liquid phases. Solid catalysts and surface reactions. Empirical and mechanistic rate equations. Parameter estimation and assessing the fit of regression models. Measuring reaction rates.

Mode of delivery:

Lectures and group exercises.

Learning activities and teaching methods:

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

Target group:

Master students in Process Metallurgy, Chemical Engineering and Chemistry.

Prerequisites and co-requisites:

Calculation of thermodynamic equilibria as well as concepts related to catalysis, chemical reactions and chemical reactors as chemical engineering or physical chemistry point of view.

Recommended or required reading:

Backgroud book:
Froment G.F., Bischoff K.B. & De Wilde J (2011) Chemical Reactor Analysis and Design, John Wiley & Sons New York 900 s. ISBN-10: 0470565411, ISBN-13: 978-0470565414

Assessment methods and criteria:

Group exercise reports and an individual modelling exam.

Grading:

1 - 5, pass, fail

Person responsible:

D.Sc. Juha Ahola

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 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, energy issues and social sciences.

Mode of delivery:

Face-to-face teaching, video lectures and project works.

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 or individual 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 (100 %). 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:

Apulaisprofessori Hannu Marttila

Working life cooperation:

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

Other information:

Maximum number of the students in the course is 20.

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 each research stage. 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, collecting experimental data, 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) Scientific research training 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 44 h.

Target group:

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

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. Materials introduced in the lectures and in Moodle.
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:

Moodle exercises (miniproject) and laboratory training.
Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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.

A432237: Module of Study Option / Hydrology and Water Management, 60 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Hydrology and Water Management

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/135 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:

Mix of guided self-study work, face-to-face teaching and field visits.

Learning activities and teaching methods:

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

Target group:

Students in master program of environmental and 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 or required reading:

Lecture hand-outs & “Lindquist, A., 2003. About water treatment. Helsingborg: Kemira Kemwater”. Optional: RIL 124-2, Vesihuolto II; Metcalf & Eddy, Wastewater Engineering: Treatment and Reuse; AWWA, Water quality & treatment; AWWA, Water treatment plant design.

Assessment methods and criteria:

The course can be completed 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 circumstances).
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 firsthand how to deal with some of the most common issues related to water and wastewater purification systems.

Other information:

The course will be held as distance learning in the fall of 2020.

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
Fundamentals of Ground Water (F.W. Schwartz, H Zhang, 2003, ISBN 0-471-13785-5) - main book, Physical and Chemical Hydrogeology (Domenico PA, Schwartz FW, 2nd edition, 1998, ISBN 0-471- 59762-7) – second option.
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 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

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 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

488144A: Water distribution and sewage networks, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: English

Leikkaavuudet:

488135S	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:

477052A Virtaustekniikka, Use of AutoCAD-program (488051A AutoCAD ja Matlab prosessi- ja ympäristötekniikan työkaluna or similar).

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.

Other information:

Replaces the course 488135S Water distribution and sewage networks, 5 ects.

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 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, energy issues and social sciences.

Mode of delivery:

Face-to-face teaching, video lectures and project works.

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 or individual 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 (100 %). 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:

Apulaisprofessori Hannu Marttila

Working life cooperation:

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

Other information:

Maximum number of the students in the course is 20.

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

Opettajat: Ali Torabi Haghighi

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, next time in 2021-22.

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 25 ECTS of Following Courses

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: Pertti Ala-Aho

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 (next time in Autumn 2020).

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:

Postdoctoral Researcher Pertti Ala-aho

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 3 (next time in Autumn 2020).

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 (next time in Autumn 2020).

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 https://www.oulu.fi/forstudents/assesment-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 is given every second spring semester (2021, 2023, 2025, etc) during period 4.

Learning outcomes:

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

Contents:

Grid-based numerical modelling, solute transport, model uncertainties, groundwater management

Mode of delivery:

Contact teaching in lectures and practical modeling sessions. Independent work on return assignment and seminar project. Option for online course participation if unable to attend in person due to compelling reasons.

Learning activities and teaching methods:

Lectures (12 h), modelling work (48 h) and self-study and report (75 h).

Target group:

Master students in the water engineering orientation of the Hydrology and Water management 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.

Recommended or required reading:

Fundamentals of Groundwater (Schwartz and Zhang 2002 ISBN: 978-0-471-13785-6), lecture material

Assessment methods and criteria:

Modelling assignments, and project work with report and presentation.

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.

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:

Course 485306S replaces this course in academic year 2019-2020.

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:

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Recommended or required reading:

Handout and other materials delivered in lectures

Assessment methods and criteria:

Written exam and exercises
Read more about assessment criteria at the University of Oulu webpage.

Grading:

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

Person responsible:

University teacher Anne Tuomela

Working life cooperation:

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

Other information:

-

488145S: Data analysis for Water Resources, 5 op

Voimassaolo: 01.01.2020 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannu Marttila

Opintokohteen kielet: English

Leikkaavuudet:

488137S	Statistical hydrology	5.0 op

Ei opintojaksokuvauksia.

488146S: Urban water management, 5 op

Voimassaolo: 01.01.2020 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: English

Leikkaavuudet:

488141S	Urban hydrology	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:

AutoCAD ja Matlab prosessi- ja ympäristötekniikan työkaluna or at least equivalent information about CAD use .477052A Fluid mechanics, 477312A Lämmön- ja aineensiirto and 488102A Hydrological Processes.

Recommended optional programme components:

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

Recommended or required reading:

Lecture handouts and materials, 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.

Other information:

This course replaces the course 488141S Urban hydrology.

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: Saara Luhtaanmäki

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
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:
Saara Luhtaanmäki
Working life cooperation:
Yes

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:
Online 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. The exams are remote exams. It is possibility to take exams also at the university.
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:
-

A433247: Supplementary module for International Master's Degree Students, 20 op

Voimassaolo: 01.08.2020 -

Opiskelumuoto: Intermediate Studies

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

For Environmental Engineering foreign students

030008P: Information Skills for foreign degree students, 1 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Faculty of Technology

Arvostelu: 1 - 5, pass, fail

Opettajat: Klintrup, Outi-Mirjami

Opintokohteen kielet: English

ECTS Credits:

1 ECTS credits / 27 hours of work

Language of instruction:

English

Timing:

1st year of Master’s Degree Programme in Environmental Engineering (BEE) and in Industrial Engineering and Management (international students). The course is held in the autumn semester, during period II and in the spring semester, during period IV.

Learning outcomes:

Upon completion of the course, the students:
- can search scientific information for their thesis,

- know how to evaluate search results and information sources,
- understand the principles of scientific publishing,
- can use a reference management tool.

Contents:

Scientific information retrieval and the search terms, the most important databases and publication channels of the discipline, tools for evaluating the quality of scientific information and reference management.

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

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

Target group:

The course is compulsory for the Master's Degree Programme in Environmental Engineering (BEE) and for the Master's Degree Programme in Industrial Engineering and Management (international students). Optional for other degree students working on their diploma/master's thesis.

Recommended or required reading:

Web learning material: "Finding scientific information"

Assessment methods and criteria:

Passing the course requires successful completion of the course assignments.

Grading:

Pass/fail

Person responsible:

Outi Klintrup

For study option "Hydrology and water management"

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 24 h, exercises 16 h and independent work 93 h. Totally 133 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.

Finnish, choose at least 5 ECTS

900017Y: Survival Finnish, 2 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900017Y	Survival Finnish Course (OPEN UNI)	2.0 op

Proficiency level:

A1.1

Status:

The course is intended for the international students in every faculty at the University of Oulu.

Required proficiency level:

No previous Finnish studies.

ECTS Credits:

2 ECTS cr

Language of instruction:

Finnish and English.

Timing:

-

Learning outcomes:

By the end of the course the student can understand and use some very common everyday expressions and phrases, and s/he can locate informational content in simple texts and messages. The student also knows the basic characteristics of Finnish language and Finnish communication styles.

Contents:

This is an introductory course which aims to help students to cope with the most common everyday situations in Finnish. During the course, students learn some useful everyday phrases, some general features of the vocabulary and grammar, and the main principles of pronunciation.

The topics and communicative situations covered in the course are: general information about the Finnish language, some politeness phrases (how to greet people, thank and apologize), introducing oneself, giving and asking for basic personal information, numbers, some time expressions (how to tell and ask the time, days of the week, time of day), food, drink and asking about prices.

The structures studied are: personal pronouns and their possessive forms, forming affirmative, negative and interrogative sentences, the conjugation of some verbs, the basics of the partitive singular and some local cases for answering the ‘where'-question.

Mode of delivery:

Contact teaching, on-line learning and independent work. There will be organized also one on-line group in each semester.

Learning activities and teaching methods:

Lessons 2 times a week (26 h, including the final exam) and guided self study (24 h).

Target group:

International degree and post-graduate degree students, exchange students and the staff members of the University.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Will be provided during the course.

Assessment methods and criteria:

Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Grading scale is on a pass/fail basis.

Person responsible:

Arja Haapakoski

Working life cooperation:

-

Other information:

Sign-up in WebOodi or in Tuudo.

900013Y: Beginners' Finnish Course 1, 3 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900013Y	Beginners' Finnish Course 1 (OPEN UNI)	2.0 op

Proficiency level:

A1 (target level A1.2)

Status:

The course is intended for the international students in every faculty of Oulu University.

Required proficiency level:

A1.1, Completion of the Survival Finnish course (900017Y) or the equivalent language skills.

ECTS Credits:

3 ECTS credits

Language of instruction:

As much Finnish as possible; English will be used as a help language.

Timing:

-

Learning outcomes:

By the end of the course the student can understand and use some familiar and common everyday expressions relating to her/himself and everyday situations. S/he can interact in a simple way provided the other person talks slowly and clearly and is willing to help. The student is able to read short simple texts and messages dealing with familiar topics. S/he also deepens her/his understanding of the Finnish language and communication styles.

Contents:

This is lower elementary course which aims to help students to learn communication skills in ordinary everyday situations. During the course, students broaden their vocabulary and knowledge of grammar and principles of pronunciation. They also practise to understand easy Finnish talk about everyday subjects, and reading and writing short and simple texts/messages.

The topics and communicative situations covered in the course are: talking about oneself, one's family, studies and daily routines, as well as asking about these things from other person; expressing opinions; food, drink and transactions in the grocery; accommodation and describing it; colours and adjectives.

The structures studied are: verb types, basics of the change of the consonants k, p and t in verbs and nouns, basics of the partitive and genitive cases, possessive structure, some declension types for nouns (word types) and the basics of the local cases.

Mode of delivery:

Contact teaching and guided self study

Learning activities and teaching methods:

Lessons 2 times a week (26 h, including the final exam) and guided self study (55 h)

Target group:

International degree and post-graduate degree students, exchange students and the staff members of the University.

Prerequisites and co-requisites:

Completion of the Survival Finnish Course

Recommended optional programme components:

-

Recommended or required reading:

Kuparinen, K. & Tapaninen, T. Oma suomi 1 (chapter 2 - 5)

Assessment methods and criteria:

Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Grading scale is 1-5.

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

Sign-up in WebOodi or Tuudo. The course will start right after the Survival Finnish course.

900053Y: Beginners' Finnish Course 2, 5 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900053Y	Beginners' Finnish Course 2 (OPEN UNI)	4.0 op

Proficiency level:

A1.3

Status:

International degree and post-graduate degree students, exchange students and the staff members of the University.
Students of the Oulu University of Applied Sciences (OAMK) students and OAMK's international and exchange students may also participate to this cross-institutional study. The quota principle is as follows: at least two OAMK students in a course and if there are more places, they are filled according to the queuing principle.
See more information for OAMK students https://www.oulu.fi/forstudents/crossinstitutionalstudy.

Required proficiency level:

A1.2, completion of the Beginners' Finnish course 1 (900013Y) or the equivalent language skills.

ECTS Credits:

5 ECTS credits

Language of instruction:

As much Finnish as possible; English will be used as a help language.

Timing:

-

Learning outcomes:

By the end of the course the student can understand and use some very common everyday expressions and sentences. S/he can communicate in easy and routine tasks requiring a simple and direct exchange of information on familiar everyday matters. The student understands different kinds of short texts. S/he can for example locate important information in them. In addition, s/he has acquired more detailed knowledge of the language and culture.

Contents:

This is a post-elementary course. During the course students learn more about communication in ordinary everyday situations in Finnish. They also extend their vocabulary and knowledge of grammar. Students practise understanding simple Finnish talk and short texts.

The topics and communicative situations covered in the course are: talking about weather, carrying out transactions in clothing stores and at the doctor's, asking about location, asking for help/favours, expressing how you are feeling, writing an invitation and email; talking about past, describing people and things; seasons, the names of the months, travelling, vehicles, body parts, adjectives, food, drink and parties.
The structures studied are: the local cases, more about the change of the consonants k, p and t, more declension types for nouns (word types), nominative plural (basic form plural), basics of the imperfect (past tense of verbs), basics of the object cases, some postposition structures, some sentence types (predicative and necessity sentences).

Mode of delivery:

Contact teaching and quided self study

Learning activities and teaching methods:

Lessons 2 times a week (52 h, including the tests) and guided self study (83 h)

Target group:

International degree and post-graduate degree students, exchange students and the staff members of the University.
Students of the Oulu University of Applied Sciences (OAMK) students and OAMK's international and exchange students may also participate to this cross-institutional study. The quota principle is as follows: at least two OAMK students in a course and if there are more places, they are filled according to the queuing principle.
See more information for OAMK students https://www.oulu.fi/forstudents/crossinstitutionalstudy.

Prerequisites and co-requisites:

Completion of the Beginners' Finnish Course 1 or the equivalent language skills.

Recommended optional programme components:

-

Recommended or required reading:

Kuparinen, K. & Tapaninen, T. Oma suomi 1 (chapters 6 - 10)

Assessment methods and criteria:

Regular and active participation in the weekly lessons (twice a week), homework assignments and tests will be taken into consideration in the assessment.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Grading scale is 1-5.

Person responsible:

Arja Haapakoski

Working life cooperation:

-

Other information:

Sign-up in WebOodi or Tuudo. Staff members in staff training portal.

900015Y: Intermediate Finnish Course 1, 5 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900015Y Intermediate Finnish Course 1 (OPEN UNI) 4.0 op

Proficiency level:

A2.1

Status:

The course is intended for the international students in every faculty at the University of Oulu.

Required proficiency level:

A1.3, Completion of the Beginners’ Finnish course 2 (900053Y) or the equivalent language skills.

ECTS Credits:

5 ECTS credits

Language of instruction:

Mainly Finnish

Timing:

-

Learning outcomes:

By the end of the course the student can communicate in ordinary everyday situations when the topics are familiar or connected with everyday matters. S/he can search for and locate key informational content in different kinds of texts. The student can also identify the topic and some details of the discussion around her/him. S/he can describe activities and personal experiences both orally and in writing and s/he also knows the difference between spoken/colloquial and written/standard language. The student knows how things can be expressed with different degrees of politeness and can apply that information in her/his own communication.

Contents:

The course is a lower intermediate course. During the course students strengthen their communication skills in ordinary everyday situations and acquire a wider vocabulary and more thorough knowledge of grammar. In addition, students practise understanding and producing Finnish talk and reading newspaper articles.

The topics and communicative situations covered in the course are: requesting different kinds of requests, expressing politeness, making appointments with friends, giving directions, doing the shopping, talking about the past and talking about his/her future plans, hobbies, transactions e.g. in the doctor's and post office.

The structures studied are: more about the imperative, the verb rections, the deverbal noun (-minen), passive present tense, part of the plural declension of nouns, the third infinitive (ma-infinitive), more about sentence types, perfect tense, more about object cases.

Mode of delivery:

Contact teaching and guided self-study.

Learning activities and teaching methods:

Lessons 2 times a week (52 h, including the tests) and guided self-study (83 h)

Target group:

International degree and post-graduate degree students, exchange students and the staff members of the University

Prerequisites and co-requisites:

Completion of the Beginners’ Finnish Course 2

Recommended optional programme components:

-

Recommended or required reading:

Gehring, S. & Heinzmann, S.: **Suomen mestari 2,** (chapters 1 - 5)

Assessment methods and criteria:

Regular and active participation in the weekly lessons (twice a week), homework assignments and the tests will be taken into consideration in the assessment.

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

Grading:

Grading scale is 1-5.

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

Sign-up in WebOodi or Tuudo.

900016Y: Intermediate Finnish Course 2, 5 op

Voimassaolo: 01.08.1995 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuyksikkö: Languages and Communication
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Proficiency level:

A2.2

Status:

The course is intended for the international students in every faculty at the University of Oulu.
Also students of the Oulu University of Applied Sciences (OAMK) may also participate to this cross-institutional study. See courses, student quota and applying for OAMK students https://www.oulu.fi/forstudents/crossinstitutionalstudy.

Required proficiency level:

A2.1, Completion of the Intermediate Finnish course 1 (900015Y) or the equivalent language skills.

ECTS Credits:

5 ECTS credits

Language of instruction:

Finnish

Timing:

-

Learning outcomes:

By the end of the course the student can communicate in various informal situations in Finnish. The student understands the main points of messages and talk around her/him. S/he can produce simple connected text on topics which are familiar or of personal interest and describe experiences and also report heard content to others.

Contents:

The course is an upper intermediate course. During the course students learn the necessary written and oral skills to be able to cope in informal situations arising during everyday life, work and study. In the course, students practise understanding more Finnish talk and written texts, and finding information and talking about it to other people. In the classes the main stress is on oral exercises and group work.
The topics and communicative situations covered in the course are: transactions e.g. in clothes shops and on the phone, Finnish small talk, reacting in different situations, information and facts about Finnish celebrations and features of colloquial/spoken language.
The structures studied are: the perfect and pluperfect, revision of all the verb tenses, comparison of adjectives, conditional, more about the plural declension of nouns (particularly the plural partitive case), more about object and predicative cases, the passive imperfect.

Mode of delivery:

Contact teaching and guided self-study

Learning activities and teaching methods:

Lessons (52 h, including the tests) and guided self-study (83 h).

Target group:

International degree and post-graduate degree students, exchange students and the staff members of the University.
Students of the Oulu University of Applied Sciences (OAMK) students and OAMK's international and exchange students may also participate to this cross-institutional study. The quota principle is as follows: at least two OAMK students in a course and if there are more places, they are filled according to the queuing principle.
See more information https://www.oulu.fi/forstudents/crossinstitutionalstudy.

Prerequisites and co-requisites:

Completion of the Intermediate Finnish Course 1 or equivalent skills

Recommended optional programme components:

-

Recommended or required reading:

Gehring, S. & Heinzmann, S.: **Suomen mestari 2 (chapters 6 - 8).**

Assessment methods and criteria:

Regular and active participation in the weekly lessons (twice a week), homework assignments and the tests will be taken into consideration in the assessment.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Grading scale is 1-5.

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

Sign-up in WebOodi or Tuudo.

900027Y: Special Course in Finnish: Writing Skills, 3 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Proficiency level:

B1/B2, according to the Common European Framework.

Status:

Course is intended for the international students in every faculty at the University of Oulu.
Students of the Oulu University of Applied Sciences (OAMK) students and OAMK's international and exchange students may also participate to this cross-institutional study. The quota principle is as follows: at least two OAMK students in a course and if there are more places, they are filled according to the queuing principle.See more information https://www.oulu.fi/forstudents/crossinstitutionalstudy.

Required proficiency level:

A2.2 Completion of the Finnish for Advanced Students (900020Y) or the equivalent language skills.

ECTS Credits:

3 ECTS credits

Language of instruction:

Finnish

Timing:

-

Learning outcomes:

By the end of the course the student can write coherent and detailed descriptions and summaries about various matters. S/he is able to summarize text and justify his/her own statements of opinions. In addition, the student knows the steps of the writing process and understands the significance of a text's function and target audience. S/he can also differentiate between formal and informal writing styles.

Contents:

During the course students develop their writing skills in Finnish and are guided in the drafting of different text types and documents needed in studies and work. In the course students learn how to write informal and formal letters, an argument-essay, a summary, a job application and a report.

Mode of delivery:

One contact lesson at the beginning of the course and guided independent studying using online

Learning activities and teaching methods:

The course will be held online using a Moodle environment.

Target group:

Course is intended for the international students in every faculty at the University of Oulu.
Students of the Oulu University of Applied Sciences (OAMK) students and OAMK's international and exchange students may also participate to this cross-institutional study. The quota principle is as follows: at least two OAMK students in a course and if there are more places, they are filled according to the queuing principle.See more information https://www.oulu.fi/forstudents/crossinstitutionalstudy.

Prerequisites and co-requisites:

Completion of the Intermediate Finnish Course 2

Recommended optional programme components:

-

Recommended or required reading:

Web based material in Moodle.

Assessment methods and criteria:

To pass the course, the student must complete all the required writing assignments.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Grading is on a pass/fail basis.

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

Sign-up in WebOodi or in Tuudo. Staff members in staff training portal.

900054Y: Conversational Skills in Finnish, 3 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Proficiency level:

B1/B2 , according to the Common European Framework.

Status:

The course is intended for the international students in every faculty at the University of Oulu. Students of the Oulu University of Applied Sciences (OAMK) may also participate to this cross-institutional study. See courses, student quota and applying for OAMK students https://www.oulu.fi/forstudents/crossinstitutionalstudy.

Required proficiency level:

A2.2
Completion of Intermediate Finnish 2 (900016Y) or the equivalent language skills.

ECTS Credits:

3 ECTS credits

Language of instruction:

Finnish

Timing:

-

Learning outcomes:

By the end of the course the student can interact with a degree of fluency (and spontaneity) that makes regular interaction with native speakers quite possible. S/he can describe and explain (clearly and in detail) on a wide range of objects, experiences and events, dreams, hopes and ambitions. The student can bring out opinions, give reasons and explanations for them and explain a viewpoint on a topical issue giving the advantages and disadvantages of various options. S/he is also able to give a (clear) prepared presentation and answer the questions posed by the audience.

Contents:

During the course students strengthen their communication skills in formal and informal situations. The goal is to activate the student's Finnish skills and encourage him/her to use them in different situations. There will be various types of situational dialogue, conversation and listening exercises in the course. In addition, students will conduct a short survey which will also be reported to other students in the class.

Mode of delivery:

Contact teaching and guided self study

Learning activities and teaching methods:

Lessons twice a week (28-30 h), group work (15 h) and guided self study (36 h)

Target group:

International degree and post-graduate degree students, exchange students and the staff members of the University. Students of the Oulu University of Applied Sciences (OAMK) may also participate to this cross-institutional study. See courses, student quota and applying for OAMK students https://www.oulu.fi/forstudents/crossinstitutionalstudy.

Prerequisites and co-requisites:

Completion of Intermediate Finnish 2 (900016Y) or equivalent skills

Recommended optional programme components:

-

Recommended or required reading:

Will be provided during the course.

Assessment methods and criteria:

To pass the course, students must attend class on a regular basis and complete group work tasks and homework assignments.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Grading is on a pass/fail basis.

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

Sign-up in WebOodi or Tuudo. Staff members in in staff training portal.

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: Markku Ohenoja
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:

Face-to-face teaching and exercises.

Learning activities and teaching methods:

The amount of guided teaching is 32 hours. Contact teaching includes, depending on situation, lectures, exercises and seminars. 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:

No prerequisites, but Matlab programming skills and understanding of process dynamics are a benefit.

Recommended optional programme components:

Courses 488051A AutoCAD and Matlab in Process and Environmental Engineering and 477501A Process Dynamics support the implementation of 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, seminar presentation and the final report.

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.) Markku Ohenoja

Working life cooperation:

No

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 understands the basic of evolutionary optimization algorithms and can use them. 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. Evolutionary algorithms in optimization. Applications in process engineering.

Mode of delivery:

Face-to-face teaching and exercises.

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 homework and classroom or home exams.

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

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 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:

This course changes to course 477610S (5 ETCS) in Academic year 21-22.

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: István Selek

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:

English

Timing:

Period 1 (autumn term)

Learning outcomes:

After completing the course, one understands the relevance and building blocks of model-based control design and system analysis. Relying on data-driven approaches, this course provides strong foundations for digital control design considering real-life applications.

Contents:

1. Control theory of linear time-invariant (LTI) systems in discrete-time (digital control). State-space representation and system analysis in time domain. Controllability, observability and related concepts. Relation of the static state feedback with PID control. Stability in Lyapunov sense. 2. Basics of LTI model identification using data. Model order reduction, model uncertainty. The relevance of LTI theory in the control of nonlinear systems. 3. Laboratory exercises with the Valmet DNA automation system.

Mode of delivery:

Regular lectures

Learning activities and teaching methods:

Lectures and exercises including 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 are recommended beforehand.

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.

Assessment methods and criteria:

Completition of homeworks and final (written) exam.

Grading:

Numerical grading scale 1-5 or fail.

Person responsible:

István Selek

Working life cooperation:

No

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: Aki Sorsa

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 is able to explain the operation principles of genetic algorithms and to use them in tuning of fuzzy set systems and neural network models.

Contents:

Fuzzy logic and fuzzy set systems, fuzzy calculus, fuzzy modelling and control, neural computation, neuro-fuzzy methods and evolutionary computation.

Mode of delivery:

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

Learning activities and teaching methods:

The amount of guided teaching is 40 hrs including lectures, exercises and a possible seminar presentation. As a self-study, students carry out homework, case study and seminar presentation preparation.

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 materials. Other literature.

Assessment methods and criteria:

This course uses continuous assessment that includes homework, classroom or home exams, case study and a possible seminar 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 uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Aki Sorsa

Working life cooperation:

No

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.

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 study the effect of sampling on the 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:

The lectures and exercise classes will be arranged as distance learning via Zoom. The Zoom-links, directions and other material (in Finnish) will be made available in the Moodle-workspace for the course, which can be found at https://moodle.oulu.fi/course/view.php?id=5361

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 Processing. Shanmugan, K.S., Breipohl, A.M.: Random Signals, Detection, Estimation and Data Analysis.

Assessment methods and criteria:

The course is completed with mid-term exams or a final exam. When completed with mid-term exams, exercise assignments are part of the continuous assessment. The assessment of the course is based on the learning outcomes of the course.

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:

-

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: Mika Ruusunen

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, students can model kinetics and dynamics of bio-technical processes (mainly fermentation) starting from the process phenomena and mass balance models. They also understands the limitations of different approaches and the modelling assumptions. They also have preliminary skills to develop models in Matlab/Simulink environment. In addition, students understand fundamentals on monitoring and optimization of bioprocesses with respect to energy, economic, and environmental issues.

Contents:

Bioreactors: models, kinetics and transfer phenomena. Models: different modelling approaches with examples. Measurements and control aspects in 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 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 the assesment criteria at University of Oulu webpage: https://www.oulu.fi/forstudents/assesment-criteria.

Grading:

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

Person responsible:

Aki Sorsa

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 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 https://www.oulu.fi/forstudents/assesment-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

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.

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: https://www.oulu.fi/forstudents/assesment-criteria .

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

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

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: Markku Ohenoja

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, optimization 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 or required reading:

Lecture notes in English

Assessment methods and criteria:

Lecture exams. Final exam is also possible.

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.) Markku Ohenoja

Working life cooperation:

No

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

Opettajat: Hiltunen, Jukka Antero

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

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

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

477123S: Chemical processing of biomasses, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisa Koivuranta

Opintokohteen kielet: English

Leikkaavuudet:

477104S	Chemical Pulping	3.0 op

ECTS Credits:

5 ECTS /133 h of work

Language of instruction:

English

Timing:

Implementation in autumn period 1

Learning outcomes:

Upon completion of the course, a student should be able to explain the value chain of chemical processing of renewable lignocellulosic raw materials to pulp and different end-products. A student is able to 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 get familiar with novel bioproduct applications.

Contents:

Lignocellulosic raw materials, fundamentals of chemical pulping, recovering of chemicals in kraft pulping, fiberline in kraft pulping, side products, environmental aspects and novel applications.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures and exercises max. 20 h, homework and self-study 113 hours.

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 intermediate exam with web learning and homework. Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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 Pulping	3.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

English

Timing:

Implementation in autumn period 2.

Learning outcomes:

Upon completion of the course, a student should be able to explain the value chain of mechanical and chemimechnical 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 max. 34 h, web learning and self-study 99 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 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 intermediate exam(s) with potential web learning and homework. Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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.

477128S: Circular Bioeconomy, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisa Koivuranta

Opintokohteen kielet: English

Leikkaavuudet:

ay477128S	Circular Bioeconomy (OPEN UNI)	5.0 op
477125S	Recycling of bioproducts	5.0 op
477106S	Recycling of Bioproducts	3.0 op

ECTS Credits:

5 cr

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 residues from forest industry. Student is familiarized with circular bioeconomy at the state-of-art level. Student is able to identify the challenges (properties, transportation ect.) of raw materials and their processing, can propose solutions and has ability to review the sustainability of final products.

Contents:

Reuse, recycling and utilization of bioproducts and side streams of forest industry in accordance with principles of circular bioeconomy. The properties and processing of raw material. Novel applications in circular bioeconomy.

Mode of delivery:

Lectures, group meetings and project work.

Learning activities and teaching methods:

Work load in the course is totally 133h. The number of lectures can vary but project working is main activities in the course.

Target group:

Students interested in circular bioeconomy.

Prerequisites and co-requisites:

488052A Introduction to Bioproduct and Bioprocess Engineering is recommended.

Recommended or required reading:

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

Assessment methods and criteria:

The assignment and seminar. More information about assessment methods is given during the course.

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:

This Course replace course 477125S Recycling of bioproducts, 5 cr.

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 and Board Manufacturing	3.0 op
477106S	Recycling of Bioproducts	3.0 op

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

Finnish

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 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:

Examination and other evaluation methods.

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.

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 Bioproduct 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.

Target group:

Students interested in bioeconomy

Prerequisites and co-requisites:

Studies in the field of bioproduct technology are recommended

Recommended or required reading:

Materials given by a supervisor.

Assessment methods and criteria:

Evaluaton of student's working skills and evaluation of research report. Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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:

The course has ended and replaced by a new course 477130S Research training of bio and circular economy.

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

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

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

488321S: Bioreactor technology, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ville-Hermanni Sotaniemi

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 mathematically describe microbial growth and product formation, enzyme catalysis and bioreactor performance. The student will also be able to use these mathematical tools to plan and analyze 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 Michaelis-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. Mixing and power consumption. Scale-up and scale-down.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures 40 h / exercises 4 h / homework 29 h / self-study 62 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 488212A Fundamentals of Catalysis or 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering) or respective knowledge.

Recommended or required reading:

Lectures: Lecture handouts; Doran, P. M. Bioprocess engineering principles. Academic Press. London, 2012. Supplementary material: Villadsen J., Nielsen J., Liden G. Bioreactor engineering principles. Springer Verlag, 2011. Shuler ML., Kargi F. Bioprocess engineering basic consepts. 2 ed. Pearson. 2002 and 2014.

Assessment methods and criteria:

Lectures, exercises, final exam, homework. Grade will be composed of final exam, exercises and homework.

Grading:

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

Person responsible:

DI Ville Sotaniemi

Working life cooperation:

No

488305S: Advanced Course for Biotechnology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Johanna Panula-Perälä

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.

Contents:

Microbial homologous and heterologous protein production. Unit operations in product recovery and purification. Biocatalyst screening and optimization. Scale-up and intensification of bioprocesses.

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures 30 h / homework 48 h / self-study 57 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 488212A Fundamentals of Catalysis or 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering and 488321S Bioreactor technology, or respective knowledge.

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.

Grading:

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

Person responsible:

TkT Johanna Panula-Perälä

Working life cooperation:

No

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: Hanna Virpiranta, Idamaria Romakkaniemi, 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:

Finnish

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 conduct bench-scale research on biotechnical processes using aseptic techniques, and to evaluate and report the results of her/his research.

Contents:

Introduction to microbial laboratory work, measurement of microbial growth, production of microbial products and calcuations related to the topic under supervision of researchers. In the end of the practicum, the student will provide an written report, including literature citations.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 2 h/ laboratory exercises 60 h/ written report and self study 73 h.

Target group:

Master's students of bioprocess engineering (A432229 Module of the Option/Bioproducts and Bioprocess Engineering, Bioprocess Engineering).

Prerequisites and co-requisites:

Courses 488212A Fundamentals of catalysis or 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering.

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:

DI Ville-Hermanni Sotaniemi

Working life cooperation:

No

Other information:

Detailed schedule of the course is informed in the starting lecture. Course has an advanced registration. Registration closes two weeks before the course begins.

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: Johanna Panula-Perälä

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 3. It is recommended to complete the course in the 4th year.

Learning outcomes:

After completing this course, the student will be able, under supervision, to prepare a research plan for the research project and perform a laboratory scale fermentation process including pre-cultivation and downstream processing.
Student can use a modern bioreactor, its automation and different biotechnological methods needed in the protein production, fermentation processes and in protein purification. Student will be able to analyze the research results and report them in written form.

Contents:

A student will perform a biotechnical manufacturing process in a group supervised by researchers 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 /research plan 8 h/ Laboratory exercises 52 h / written report and literature research 73h

Target group:

Master students in the study option bioprocess engineering (A431231 Module of the Option /Bioproducts and Bioprocess Engineering, Bioprocess Engineering).

Prerequisites and co-requisites:

488212A Fundamentals of catalysis or 488309A Biocatalysis,
488052A Introduction to Bioproduct and Bioprocess Engineering,

488311S Industrial microbiology,
488311S Bioreactor technology
or respective knowledge.

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:

Laboratory work and written report. 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:

TkT Johanna Panula-Perälä

Working life cooperation:

No

Other information:

Detailed schedule of the course is informed in the starting lecture.
Course has an advanced registration. Registration closes two weeks before the course begins.

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

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 writing of a synopsis on this subject. The module is arranged into lectures or workshops, and writing the synopsis. All of the course materials are in English, but both English and Finnish are used in teaching. Both a final examination and continuous assessment will count towards the final mark.

Mode of delivery:

Face to face teaching

Learning activities and teaching methods:

30 h lectures, plus exercises

Target group:

Minor subject students

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Appling et al. Biochemistry – Concepts and Connections (2nd edition, 2019) Pearson Education Limited; ISBN 10: 1-292-26720-8, or equivalent

Assessment methods and criteria:

Continuous assessment, final examination

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 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:

No

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: Mika Ruusunen

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, students can model kinetics and dynamics of bio-technical processes (mainly fermentation) starting from the process phenomena and mass balance models. They also understands the limitations of different approaches and the modelling assumptions. They also have preliminary skills to develop models in Matlab/Simulink environment. In addition, students understand fundamentals on monitoring and optimization of bioprocesses with respect to energy, economic, and environmental issues.

Contents:

Bioreactors: models, kinetics and transfer phenomena. Models: different modelling approaches with examples. Measurements and control aspects in 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 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 the assesment criteria at University of Oulu webpage: https://www.oulu.fi/forstudents/assesment-criteria.

Grading:

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

Person responsible:

Aki Sorsa

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: Tanskanen, Juha Petri

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. 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, chemical reaction equilibrium, vapour/liquid equilibrium, introduction to the use of Aspen Plus in the calculation of a thermodynamic equilibrium state, 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 of Chemical Engineering, and Bioproducts and bioprocesses.

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, 2005. (7th ed.) ISBN 0-07-124708-4

Assessment methods and criteria:

Combination of a final exam and home 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 https://www.oulu.fi/forstudents/assesment-criteria.

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

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 spring semester during the 3th period. It is recommended to complete the course at the fourth (1st Master's) spring 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 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 https://www.oulu.fi/forstudents/assesment-criteria

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: 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 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

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 https://www.oulu.fi/forstudents/assesment-criteria

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

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 spring semester during the 3th period. It is recommended to complete the course at the fourth (1st Master's) spring 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 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 https://www.oulu.fi/forstudents/assesment-criteria

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:

Student recognizes the connection between catalysis and green chemistry and the role of catalysis in sustainable processes, energy production, and environmental engineering. Student is able to explain the most important industrial catalytic processes, the use of catalysts in environmental technology, and the importance of catalyst research.

Contents:

Catalyst and catalysis, sustainability. Catalysis in industry. Environmental catalysis.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 20 h, exercises 10 h, teamwork presentations 20 h, portfolio work 40 h and self-study 60 h.

Target group:

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

Prerequisites and co-requisites:

488212A Katalyysin perusteet or 488309A Biokatalyysi

Recommended or required reading:

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Assessment methods and criteria:

Portfolio and written examination

Grading:

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

Person responsible:

Satu Pitkäaho and Esa Turpeinen

Working life cooperation:

No

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: Muurinen, Esa Ilmari

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, next time 2021-22.

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 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 https://www.oulu.fi/forstudents/assesment-criteria

Grading:

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

Person responsible:

Esa Muurinen

Working life cooperation:

No

477310S: Advanced Catalytic Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

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 (next time in Autumn 2020).

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 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 https://www.oulu.fi/forstudents/assesment-criteria .

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

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 https://www.oulu.fi/forstudents/assesment-criteria.

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

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 22h, 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:

Docent Dr Esa Muurinen

Working life cooperation:

No

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: Tanskanen, Juha Petri

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. 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, chemical reaction equilibrium, vapour/liquid equilibrium, introduction to the use of Aspen Plus in the calculation of a thermodynamic equilibrium state, 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 of Chemical Engineering, and Bioproducts and bioprocesses.

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, 2005. (7th ed.) ISBN 0-07-124708-4

Assessment methods and criteria:

Combination of a final exam and home 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: Tanskanen, Juha Petri

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:

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

Mode of delivery:

Face-to-face teaching, introductory examples and group exercises with a 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:

-

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. 3rd 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:

Numerical grading scale, 0-5. Zero stands for a fail.

Person responsible:

Dr Jani Kangas

Working life cooperation:

No

Other information:

-

477524S: Process Optimization, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

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 understands the basic of evolutionary optimization algorithms and can use them. 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. Evolutionary algorithms in optimization. Applications in process engineering.

Mode of delivery:

Face-to-face teaching and exercises.

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 homework and classroom or home exams.

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

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 https://www.oulu.fi/forstudents/assesment-criteria

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

477224S: Biorefineries, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477208S	Biorefineries	3.0 op

ECTS Credits:

5 ECTS /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 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

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.

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:

-

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). 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, 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:

Although it is not required to participate on lectures, it is highly recommended that the students are active and do the required exercises from the very beginning of the course due to continuous assessment used in this course.

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.

477420S: Current and future status of metal production, 5 op

Voimassaolo: 01.08.2019 - 31.07.2021

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:

477425S	Current and future status of process industry	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 II. It is recommended to complete the course at the 5th autumn semester.

Learning outcomes:

Student can estimate how national and global trendsinfluence metal production now and in the future.

Contents:

Contents vary each year. Focus is on current issues and features e.g. availability and price of raw materials and energy, available technologies, juridical restrictions, environmental issues, digitalisation as well as research and development.

Mode of delivery:

Classroom education

Learning activities and teaching methods:

Lectures and discussions (max. 48 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 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 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 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 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.

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 ECTS credits / 134 hours of work

Language of instruction:

Finnish. English on demand.

Timing:

4th or 5th spring. The course is lectured every other year.

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

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 ECTS credits / 134 hours of work

Language of instruction:

Finnish. English on demand.

Timing:

4th or 5th spring. The course is lectured every other year.

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

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 ECTS credits / 130 hours of work

Language of instruction:

Finnish/English

Timing:

The course is held in the spring semester, during the period 4. It is recommended to complete the course at the 4^{th} or 5^{th} spring semester.

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, Moodle learning environment

Learning activities and teaching methods:

Lectures 40 h, self-studies 90 h of which a part is done as independent work in the learning environment.

Target group:

Chemistry, chemistry teacher, process technology

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the following courses: Physical chemistry I and 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. Examination based on the lectures.

Assessment methods and criteria:

Final examination.

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:

The course includes the guest lectures from industry.

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 ECTS credits / 134 hours of work

Language of instruction:

Finnish/English on demand

Timing:

4th or 5th spring. The course is lectured every other year.

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

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 ECTS credits / 134 hours of work

Language of instruction:

Finnish/English on demand

Timing:

4th or 5th autumn. The course is lectured every other year.

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:

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:

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

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 ECTS credits / 135 hours of work

Language of instruction:

Finnish/English

Timing:

The course is held in the autumn semester, during the period 1 (every other year). It is recommended to complete the course at the 4th or 5th autumn semester.

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, Moodle learning environment.

Learning activities and teaching methods:

Lectures 40 h, self-studies 90 h of which a part is done as independent work in the learning environment.

Target group:

Chemistry, chemistry teacher, process technology

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the following courses: Physical chemistry I and 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.

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:

The course does not contain working life cooperation.

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

477225S: Reaction Kinetics, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ahola, Juha Lennart
Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Spring period 4.

Learning outcomes:

The student is able to formulate kinetic rate equation for chemical reactions. Student is familiar with typical methods for parameter estimation and criteria for assessing the goodness of the model as well as recognize the experimental methods in chemical reaction engineering. Student is able to applied the kinetic models for analysis of chemical reactions. Contents: Formulation of material and energy balances by taking into account the effects of chemical reactions.

Contents:

Chemical reactions is gas and liquid phases. Solid catalysts and surface reactions. Empirical and mechanistic rate equations. Parameter estimation and assessing the fit of regression models. Measuring reaction rates.

Mode of delivery:

Lectures and group exercises.

Learning activities and teaching methods:

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

Target group:

Master students in Process Metallurgy, Chemical Engineering and Chemistry.

Prerequisites and co-requisites:

Calculation of thermodynamic equilibria as well as concepts related to catalysis, chemical reactions and chemical reactors as chemical engineering or physical chemistry point of view.

Recommended or required reading:

Backgroud book:
Froment G.F., Bischoff K.B. & De Wilde J (2011) Chemical Reactor Analysis and Design, John Wiley & Sons New York 900 s. ISBN-10: 0470565411, ISBN-13: 978-0470565414

Assessment methods and criteria:

Group exercise reports and an individual modelling exam.

Grading:

1 - 5, pass, fail

Person responsible:

D.Sc. Juha Ahola

780660S: Advanced water treatment chemistry, 5 op

Voimassaolo: 01.08.2018 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Chemistry
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 134 hours of work

Language of instruction:

Finnish and English

Timing:

Implementation as a net course, available in optional schedule (net tutors not available in July). Deadline for course materials created by student within 2 months from beginning. When starting course, contact anne.heponiemi@oulu.fi or sari.tuomikoski@oulu.fi to get the rights to Moodle workspace.

Learning outcomes:

After this course, student:
- knows legislation requirements and suggestions for municipal domestic water and wastewater in Finland
- knows water and wastewater treatment unit operations, chemical reactions and phenomena concerning to the treatment
- has created comprehensive dictionary regarding to municipal domestic and wastewater treatment

Contents:

Legislation concerning to the municipal domestic water and wastewater treatment and physical, chemical and biological unit operations as a treatment method. Case studies from municipal domestic water and wastewater treatment.

Mode of delivery:

Net course

Learning activities and teaching methods:

134 hours of self-study

Target group:

Chemistry, process and environmental engineering, open university, further education

Prerequisites and co-requisites:

General and inorganic chemistry A (780117P) and B (780118P) (or same knowledge).

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:

Finlex Legislation https://www.finlex.fi/en/
Letterman R.D, Water quality and treatment, fifth edition, American water works association, McGraw-Hill handbooks.
Metcalf and Eddy. Wastewater Engineering: treatment and reuse. 4. painos, Boston, McGraw-Hill, 2003.
RIL 124-1-2003 Vesihuolto I ja II, editor Karttunen E.
Scientific articles

Assessment methods and criteria:

Passing the course includes exploring to domestic and wastewater treatment technologies in Finland and the preparation of wide terminology regarding to water treatment. Course includes also the filling preliminary knowledge template and the final feedback of the course. Course work will be returned to Moodle workspace. In addition to the contents, the quality of the references and the layout of the work will be taken into account during evaluation.

Grading:

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

Person responsible:

Anne Heponiemi, Sari Tuomikoski

Working life cooperation:

No

782608S: Battery chemistries and components, 5 op

Voimassaolo: 01.01.2019 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Chemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Ulla Lassi

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits / 130 hours of work

Language of instruction:

English

Timing:

The course is held in the spring semester, during the period 3. It is recommended to complete the course at the 4^{th} or 5^{th} spring semester.

Learning outcomes:

The student will learn the basic knowledge of the battery materials and structures. The student understands the operation principle of Li-ion battery, its structure, cell assembling. Further, student will learn how to improve the battery performances and especially, battery development from green chemistry viewpoint. The student will familiarize basics of chemistry and components in the battery system.

Contents:

Battery types and history; Lithium ion battery and principle; Anode and cathode materials used in lithium ion batteries; Electrolytes and other significant components for lithium-ion batteries; Preparation of a single battery cell, Battery cell assembling; Overview of other potential battery technologies.

Mode of delivery:

Web-based learning, Moodle learning environment.

Learning activities and teaching methods:

Lectures 40 h in the web, self-studies 90 h of which a part is done as independent work in the learning environment.

Target group:

Chemistry, chemistry teacher, process technology

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the following courses: Physical chemistry I and 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. Examination based on the lectures.

Assessment methods and criteria:

Final examination.

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:

The course includes the guest lectures from industry.

A433246: Process and Environmental Engineering / Supplementary Module, Industrial Engineering, 30 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Advanced Studies
Laji: Study module
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Industrial Engineering

555285A: Project management, 5 op

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

555288A	Project Management	5.0 op
ay555285A	Project management (OPEN UNI)	5.0 op
555282A	Project Management	4.0 op
555280P	Basic Course of Project Management	2.0 op

ECTS Credits:

5 ECTS credits.

Language of instruction:

Finnish. Check the course in English 555288A Project Management.

Timing:

Period 2.

Learning outcomes:

Upon completion of the course, the student will be able to:

- describe explain the essential concepts and methods related to project management
- apply project management methods to create a schedule for a project and calculate critical path
- understand essential concepts related to project cost management and able to apply earned value method and three point estimate to manage project costs
- recognises the essential tasks of project risk management

Contents:

Defining project management, project goals and objectives, project phases and project life-cycle management, project planning, organising and scope management, schedule management, cost management, earned value calculation and project risk management, project stakeholder management, project communications management, the role of project manager, new modes of project delivery

Mode of delivery:

The tuition will be implemented as web-based teaching.

Learning activities and teaching methods:

Web-based lectures 16h, self-study 118h

Target group:

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

Prerequisites and co-requisites:

No prerequisites exist.

Recommended optional programme components:

This course is part of the 25 ECTS module of Industrial engineering and management that also includes555225P Basics of industrial engineering and management, 555242A Product development, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

Recommended or required reading:

Lecture material, exercise book, Artto, Martinsuo & Kujala 2006. Projektiliiketoiminta. WSOY

Assessment methods and criteria:

Weekly assignments and final online exam

Grading:

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

Person responsible:

Assistant professor Kirsi Aaltonen

Working life cooperation:

Videos from the industry’s projects

Other information:

Substitutes courses 555280P Basic Course of Project Management + 555282A Project Management.

555242A: Product development, 5 op

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Haapasalo, Harri Jouni Olavi

Opintokohteen kielet: English

Leikkaavuudet:

ay555242A Product development (OPEN UNI) 5.0 op

555240A Basic Course in Product Development 3.0 op

ECTS Credits:

5 ECTS credits.

Language of instruction:

English.

Timing:

Periods 1-2.

Learning outcomes:

This course introduces product development and innovations management in a company environment. The course provides fundamental understanding over tools and frameworks that can be used for analysing and managing products, innovations, and technology development. The aim is to create a connection between product development and other company functions. Upon completion of the course, the student will be able to

- explain the role of product development as a company function
- understand the difference between innovation activities and systematic product development, and knows the difference between different phases of product development process and its activities
- transform customer needs into requirements for product development process and finally into product features
- define the meaning of other company functions to product development activities

Contents:

Meaning of products for the operations of an industrial enterprise, product development paradigm and defining relevant concepts, realising product development methodologically (U&E model, Cooper's stage-gate model, QFD), managing innovations, and product development success factors.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 20 h / exercises 6 h / group work and self-study 108 h.

Target group:

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

Prerequisites and co-requisites:

555226A Operations and supply chain management (Operations and production)

Recommended optional programme components:

This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555285A Project management, 555264P Managing well-being and quality of working life, and 555286A Process and quality management.

Recommended or required reading:

Handouts, course work, and a collection of articles. Ulrich, K. & Eppinger, S. (2008) Product Design and Development. McGraw-Hill. 358 p.

Assessment methods and criteria:

Exam and group work.

Grading:

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

Person responsible:

Professor Harri Haapasalo.

Working life cooperation:

No.

Other information:

Substitutes course 555240A Basic Course in Product Development.

555226A: Operations and supply chain management, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Farzad Pargar

Opintokohteen kielet: English

Leikkaavuudet:

555222A Demonstration in Industrial Engineering and Management 2.0 op
555223A Introduction to Production Control 3.0 op

ECTS Credits:

5 ECTS credits

Language of instruction:

English.

Timing:

Periods 1-2.

Learning outcomes:

Upon completion of the course, the student will be able to:

- describe different production types
- apply different forecasting methods, plan needed production capacity, and apply location and transportation decisions related methods
- master common inventory management methods and aggregated and short-term scheduling
- create a sales and operations plan for a company

Contents:

Production types, forecasting methods, capacity planning and queuing models, location and transportation decisions, inventory management systems, aggregate scheduling, MRP & ERP, short-term scheduling, linear programming.

Mode of delivery:

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

Learning activities and teaching methods:

Lectures 16 hours / independent studying 64 hours.

Target group:

Industrial Engineering and Management students.

Prerequisites and co-requisites:

555225P Basics of industrial engineering and management or similar knowledge.

Recommended optional programme components:

Industrial Engineering and Management students will complete 902143Y Company presentations course simultaneously.

Recommended or required reading:

Lecture and exercise materials. Krajewski, L.J. et al. (2012) Operations management: processes and supply chains, 10th ed. Pearson. In addition, recommended material includes chapter 13 in Heizer, J. & Render, B. (2014) Operations management: sustainability and supply chain management, 11th ed. Pearson.

Assessment methods and criteria:

This course utilises continuous assessment. During the course, there are mandatory weekly assignments. At least half of the assignments must be passed. 40 % of the grade is based on the group work.

Grading:

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

Person responsible:

Post-doctoral researcher Farzad Pargar.

Working life cooperation:

The group work will be done for a real company by using public information sources.

Other information:

Substitutes course 555222A Demonstration in Industrial Engineering and Management 2 ECTS cr and 555223A Introduction to Production Control 3 ECTS cr.
Previous course name was 'Operations and Production'.

555286A: Process and quality management, 5 op

Voimassaolo: 01.01.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Osmo Kauppila

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay555286A	Process and quality management (OPEN UNI)	5.0 op
555281A	Basic Course of Quality Management	5.0 op

ECTS Credits:

5 ECTS credits.

Language of instruction:

Finnish.

Timing:

Period 4.

Learning outcomes:

Upon completion of the course, the student will be able to:

- explain the role of process and quality management in a business organisation
- develop business processes based on the principles of quality management and appropriate tool

Contents:

Foundations of total quality management, planning of quality, performance measurement, process management, people management in relation to quality management, implantation of total quality management.

Mode of delivery:

The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:

20 h lectures, 114 h independent study

Target group:

Industrial Engineering and Management students and other students studying Industrial Engineering and Management as minor.

Prerequisites and co-requisites:

-

Recommended optional programme components:

This course is part of the 25 ECTS module of Industrial engineering and management that also includes 555225P Basics of industrial engineering and management, 555285A Project management, 555242A Product development, and 555264P Managing well-being and quality of working life.

Recommended or required reading:

Oakland, J.S. (2014) Total quality management and operational excellence (4th ed.). Routledge, 529 pp. and material handed out during the course.

Assessment methods and criteria:

To pass the course, the student must pass the weekly course exercises (50 % of the course grade) and an exam (50 %).

Grading:

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

Person responsible:

University lecturer Osmo Kauppila.

Working life cooperation:

No.

Other information:

Substitutes course 555281A Basic Course of Quality Management.

555390S: Process Analytics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Osmo Kauppila

Opintokohteen kielet: Finnish

Leikkaavuudet:

555380S	Quality Management	5.0 op

ECTS Credits:

5 ECTS credits.

Language of instruction:

Finnish.

Timing:

Period 1.

Learning outcomes:

Upon completion of the course, the student will be able to:

- analyse and improve the processes of an organisation with the help of statistical tools
- disseminate the applicability of various statistical tools and methods in different kinds of organisational environments

Contents:

Processes in an organization from a statistical viewpoint, tools and methods of statistical process control, process improvement using numeric data, stages, challenges and implementation of data analysis, the role of statistical methods in various management philosophies.

Mode of delivery:

The tuition will be implemented as face-to-face teaching (integrated classroom lectures and exercises).

Learning activities and teaching methods:

28 h lectures, 106 h independent study on course exercises.

Target group:

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

Prerequisites and co-requisites:

555286A Process and Quality Management

Recommended optional programme components:

-

Recommended or required reading:

Foreman, J. (2014) Data smart: using data science to transform information into insight. Wiley & Sons: Indianapolis. Other material handed out during the course.

Assessment methods and criteria:

To pass the course, the student must complete the course exercises. The course grade is determined by the completeness and independent thought demonstrated in the set of exercises.

Grading:

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

Person responsible:

University lecturer Osmo Kauppila.

Working life cooperation:

No.

Other information:

Substitutes course 555380S Quality Management.

555389S: Systematic Process Improvement, 10 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Osmo Kauppila

Opintokohteen kielet: Finnish

ECTS Credits:

10 ECTS credits.

Language of instruction:

Finnish

Timing:

Periods 1 - 2

Learning outcomes:

Upon completion of the course, the student will be able to:

- manage the improvement and problem solving in a process using quality management tools
- explain the steps of the DMAIC problem solving model and apply the correct tools for each step
- apply quality tools into real life process data with the help of MINITAB software and to analyse the results
- increase his/her understanding of the process type studied in the course exercise

Contents:

Problem solving using DMAIC, the Six Sigma body of knowledge quality tools, use of MINITAB software, process improvement in practice.

Mode of delivery:

The tuition will be implemented as blended teaching.

Learning activities and teaching methods:

Lectures and related exercises, site visit, a large group exercise related to a process operating in practice.

Target group:

Industrial Engineering and Management students, other students taking Industrial Engineering and Management as minor, postgraduate students.

Prerequisites and co-requisites:

Bachelor in Industrial Engineering and Management or equivalent. Basic knowledge of statistical process control.

Recommended optional programme components:

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Recommended or required reading:

Kubiak, TM & Benbow DW (2009) The Certified Six Sigma Black Belt Handbook, Second Edition. ASQ Quality Press, Milwaukee. 620 s. and material handed out during the course.

Assessment methods and criteria:

To pass the course, the student must complete the group work as an active team member (50 % of the course grade), take part in the course lectures and return the related exercises (50 %).

Grading:

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

Person responsible:

University lecturer Osmo Kauppila.

Working life cooperation:

a group exercise related to a process operating in practice.

Other information:

-

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

ECTS Credits:
0 ECTS
Language of instruction:
Finnish, Swedish or English.
Timing:
After completion of the master's thesis.
Learning outcomes:
The student can produce text in popular form of the research field and thus show ones familiarity to the field.
Contents:
Depends on the topic of the thesis.
Mode of delivery:
Literary work.
Learning activities and teaching methods:
Exam
Target group:
Master Students of Environmental Engineering
Assessment methods and criteria:
Student writes an essay about the topic of the Master's thesis to show a good command of the content of the thesis
Grading:
Pass or fail
Person responsible:
Supervisor of Thesis

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

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:

Saara Luhtaanmäki

Working life cooperation:

Older students tell their working life experience.

031010P: Calculus I, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Pauliina Uusitalo

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 will be lectured also in English.

Timing:

Fall, period 1

Learning outcomes:

Upon completion of the course, the student
- knows how to solve inequalities and equations with absolute value
- identifies the concepts of vector algebra
- can use vector algebra for solving the problems of analytic geometry
- can explain basic characteristics of elementary functions
- is able to analyse the limit and the continuity of the real valued functions of one variable
- can analyse the local minima and maxima of a function
- knows how to find the derivative for a function given with parametric representation
- is able to evaluate the basic calculation of the complex numbers and can rewrite a complex number in its exponential form
- knows the connection between the integral and area
- knows integral techniques such as integration by parts, a substitution method and a partial fraction composition
- can solve problems associated with the differential and integral calculus of the real valued functions of one variable.

Contents:

- Inequalities and absolute value
- Vector algebra and analytic geometry
- Concept of the function and elementary functions
- Monotonicity of the function, the inverse function
- Limit values
- Derivative as limit value of the difference quotient. Derivatives of elementary functions
- The extreme values of a function
- Parameter presentation of the curve, polar coordinates, complex numbers
- Integral function and definite integral, applications
- Integration by parts, substitution method and integration of rational functions

Mode of delivery:

Blended learning, course material is in Moodle learning environment

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:

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:

The course is completed with mid-term exams or a final exam. When completed with mid-term exams, exercise assignments are part of the continuous 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 0-5. In the numerical scale zero stands for a fail.

Person responsible:

Pauliina Uusitalo

Working life cooperation:

The course does not contain working live 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:

-

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: Pauliina Uusitalo

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:

Online 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. The exams are remote exams. It is possibility to take exams also at the university.
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:

Pauliina Uusitalo

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:

Online 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. The exams are remote exams. It is possibility to take exams also at the university.
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:

-

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:

Online teaching, Stack/Moodle digital learning environment

Learning activities and teaching methods:

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

Target group:

1. year students of engineering, 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:

Recommended 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:

No

761118P: Mechanics 1, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Physics

Arvostelu: 1 - 5, pass, fail

Opettajat: Aku Venhola

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 2-14. Also older and newer 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: Two midterm exams or final examination
761118P-02: Two laboratory exercises.

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Aku Venhola

Working life cooperation:

No work placement period

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 ECTS 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 and reports.

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, Biology: optional.

Prerequisites and co-requisites:

Basic Principles in Chemistry (780120P, 5 cr) or General and Inorganic Chemistry A (780117P, 5 cr). Student is allowed to participate to the course simultaneously when participating the prerequisites. Attendance at the lecture of Safety in laboratory is compulsory.

Recommended optional programme components:

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

Recommended or required reading:

Instruction Book (in Finnish)

Assessment methods and criteria:

Accomplishment of the course requires accepted preparatory problems, laboratory exercises and problems related to them.

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.

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 ECTS 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.: Organic Chemistry: A Short Course, 10. ed. or newer, Houhgton Mifflin, Boston, 1999; Hart, H. ja Hart, D.: Study Guide & Solutions Book, Organic Chemistry: A Short Course, 10. ed. or newer, Houghton Mifflin, Boston, 1999 and material in Moodle.

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

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 / tasks and 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:

Group work 0-5, the assessment of the tasks will be informed at the beginning of the course.

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.

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 credit / 27 hours of work

Language of instruction:

Finnish

Timing:

Architecture 3. spring semester, period III;
biochemistry 3. autumn semester;
biology 3. autumn semester, period I;
chemistry 3. autumn semester, period I;
civil engineering 2. spring semester, period IV;
computer science and engineering 2. spring semester, period IV;
electronics and communications engineering 3. spring semester;
geosciences 2. spring semester, period IV;
geography 3. semester, periods I and III;
industrial engineering and management 3. year;
information processing sciences 1. or 3. 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;
Master's degree students in industrial engineering and management 1st year.

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 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.

Recommended optional programme components:

In biochemistry the course is completed as a part of 740376A Bachelor's Thesis.

Recommended or required reading:

Web learning material Tieteellisen tiedonhankinnan opas

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

Choose 2 courses

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

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

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 ECTS credits / 134 hours of work

Language of instruction:

Finnish

Timing:

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

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.

Grading:

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

Person responsible:

Minna Tiainen

Working life cooperation:

No

521141P: Elementary Programming, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Computer Science and Engineering DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Mika Oja

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay521141P	Elementary Programming (OPEN UNI)	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 ECTS Cr

Language of instruction:

Lectures and learning material are in Finnish. The course is not available English.

Timing:

Fall, periods 1-2.

Learning outcomes:

1. Is capable of solving problems in the computer's terms

2. Understands the basic concepts of programming

3. Knows the basics of the Python programming language

4. Is able to implement programs independently

5. Is able to use the internet to find information about programming

Contents:

Problem solving with programming, basic concepts of programming, writing Python code.

Mode of delivery:

Web-based teaching + face-to-face teaching

Learning activities and teaching methods:

30h of exercise groups, 105h self-studying in the web.

Target group:

1 st year students of computer science and engineering, electrical engineering, medical and wellness technology and industrial and engineering management, 2nd year students of physics, and other students of the University of Oulu

Prerequisites and co-requisites:

None.

Recommended optional programme components:

The course provides a basis for subsequent programming courses.

Recommended or required reading:

Web material in an online learning environment. Address will be announced at the beginning of the course.

Assessment methods and criteria:

The course is completed by passing all learning assignments, programming exercises and a final exercise project. Read more about assessment criteria at the University of Oulu webpage
Read more about assessment criteria at the University of Oulu webpage.

Grading:

pass/fail.

Person responsible:

Mika Oja

Working life cooperation:

-

Other information:

The course learning platform is Lovelace (lovelace.oulu.fi)

811104P: Programming 1, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Lappalainen, Jouni Esko Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay811104P Programming 1 (OPEN UNI) 5.0 op

811122P Introduction to Programming 5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

Finnish

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 of the Bachelor's studies.

Learning outcomes:

After completion of this course, the student will be able to:
* create simple working programs
* identify and use the basic control structures of a program.
* identify the concepts of modularity, table, storage of information.
* apply the concepts of modular structure, tables and information storage techniques into a program.
* find and fix errors in the program.
* solve a computational problem by using abstraction and stepwise refinement
* explain the concept of recursion.
* operate with binary and hexadecimal number systems, as well as knows the presentation of numbers on a computer.
* document the program.

Contents:

1. Software design method (waterfall) 2. Problem solving 3. Stepwise refinement 4. Control structures 5. Modular programming, calling modules, communication between modules 6. Data types 7. Arrays 8. Pointers 9. Character strings 10. Data structures 11. Storing data.

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

Theory studies at lectures and/or online (in Finnish) 40h, programming exercises in a computer lab and/or an online learning environment 24h, self-study 70h

Target group:

BSc students

Recommended or required reading:

Deitel, Deitel: C HOW TO PROGRAM; Pearson Education Inc. 2007, or a newer edition. Lecture slides.

Assessment methods and criteria:

1. Final exam and exercise points and programming assignment. OR 2. Mid-term exams (2) and exercise points and home programming assignment.

Grading:

Numerical scale 1-5 or fail

Person responsible:

Jouni Lappalainen

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:

This course is only for Finnish speaking students with CEFR-level A2 in Swedish language. University of Oulu, Languages and Communication unit don’t offer Beginners courses in Swedish.

Recommended optional programme components:

-

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

Proficiency level:

The course is intended for the students who´s schooling language is Swedish. See 900081Y Second Official Language (Finnish), Written Skills.

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,
- evaluate your own strengths and weaknesses in English-language communication, with a view to developing appropriate skills in future.

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 own 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 / independent work 29 hours. Lessons include regular pair and group work in class. Independent homework activities include team work for the preparation of four short presentations, vocabulary study and other small assignments. Active participation is essential.

Target group:

Students in the engineering programmes: TTK (PO1, YMP1, KO1, TuTa1, RaKy), 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.
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:

-

902141Y: Oral Fluency, 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 Level: B2 (Lower - Average)

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 the 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. Check the study guide for availability in your department.

Learning outcomes:

Learning outcomes - By the end of the course, you are expected to:
1. demonstrated oral fluency for dealing with a wide variety of work-related and social situations,
2. demonstrated an ability to express your own thoughts and opinions in paired or small group discussions,
3. demonstrated understanding of others' contributions in paired or small group discussions,
4. initiated self-directed language learning strategies, including personal goal-setting and self-evaluation, to help you learn effectively in future.

Contents:

Designed for students with weaker self-confidence as English-speakers, this course aims to facilitate the development of oral fluency. The lessons offer extensive speaking practice in pairs and small groups, activating passive knowledge of vocabulary and structure, and helping you gain confidence in your English speaking and listening skills.
This module offers a comfortable environment in which to practice speaking over a wide range of different oral communication activities, including simulations, role-play, improvised or guided situational dialogue, and free conversation. You will also develop your English communication skills and language learning strategies through self-directed homework activities, on which you will report regularly in class, as well as in a final written report at the end of the semester.

Mode of delivery:

Contact teaching and independent study

Learning activities and teaching methods:

Lessons 26 hours. Active participation is essential.
Independent work 27 hours.

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 will be provided by the teacher in electronic form.

Assessment methods and criteria:

Continuous assessment will be based on on the learning outcomes of the course, as demonstrated in a) active participation in oral activities in class and b) the quality of the written homework.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Pass/Fail

Person responsible:

Susan McAnsh - See contact teachers

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. Check the study guide for availability in your department.

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 online 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 online course 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 and TST).

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:

Susan McAnsh

Working life cooperation:

-

Other information:

-

902144Y: Environmental Issues, 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 ECTS credits. The workload is 53 hours.

Language of instruction:

English

Timing:

The course takes place in spring (periods 3 and 4) semester.

Learning outcomes:

By the end of the module, you are able to

- use a comprehensive vocabulary related to environmental matters,
- discuss environmental issues with a reasonable degree of fluency,
- give clear, well-structured and audience-friendly presentations on topics related to the environment.

Contents:

This course focuses on language skills you need to discuss environmental matters, with particular focus on vocabulary development and presentation skills.
The subject matter for the course will draw on interdisciplinary materials, and you will increase your knowledge of up-to-date environmental topics. You will be required to consider controversial issues and be prepared to contribute your own opinions in debate within the class, as well as giving three short presentations to a small group of participants.

Mode of delivery:

Contact teaching and independent study

Learning activities and teaching methods:

Lessons 26 hours / independent work 27 hours. Lessons include regular pair and group work in class. Independent work includes the preparation of three short presentations (18 hours), as well as other independent homework activities (9 hours). Active participation is essential.

Target group:

Students in the engineering programmes (TTK and TST), particularly students of Environmental Engineering.

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), particulary students of the Environmental Engineering.

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. Students must give three short presentations demonstrating the skills specified in the learning outcomes.
Read more about assessment criteria at the University of Oulu webpage.

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
(Alla 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 teachers 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. Check the study guide for availability in your department.

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 four basic areas:
i) business communication
ii) social and cultural aspects of 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:

Susan McAnsh

Working life cooperation:

-

Other information:

See contact teachers, https://www.oulu.fi/kielikoulutus/node/56574.)

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. Check the study guide for availability in your department.

Learning outcomes:

By the end of the course, you are expected to
1) explain and apply general academic / scientific vocabulary from Coxhead's Academic Word List (AWL)
2) differentiate between informal (non-academic) and formal / academic language,
3) demonstrate use of academic vocabulary in a variety of writing and communication contexts.

Contents:

The general aim of this course is 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 (AWL). During this process, you will become aware of the strategies which best promote your skills to learn and memorise vocabulary. 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 work on various 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 a written academic essay or report; vocabulary tests; presentations, which will be given in class to small groups of students; and other homework assignments. 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. Satisfactory completion of the in-class/ homework assignments and the vocabulary tests is required.
See more about assessment criteria, https://www.oulu.fi/forstudents/assesment-criteria.

Grading:

Pass/Fail

Person responsible:

Susan McAnsh. See contact teachers, https://www.oulu.fi/kielikoulutus/node/56574.

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, you work independently, studying online handouts and consolidating your 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) each term in a classroom on the Linnanmaa campus.
Lue lisää opintosuoritusten arvostelusta yliopiston verkkosivulta.

Grading:

Pass/Fail

Person responsible:

Susan McAnsh - See contact teachers

Working life cooperation:

-

Other information:

The course will be organized by online tutoring.
You can enroll for the exam only if you have been accepted for the MoW course during this semester (so enroll first) or in the last two years (do not re-enroll).
You cannot take the exam without registering.
Acceptance information for the course will be sent to your university email address, so make sure your university email address is up to date in WebOodi.

Please, contact the teacher directly if you have any questions about the exam or any other subject related to the course.
Note! Registration for each test separately -> Exams begin on the hour and last 120 minutes.

902121Y: Other Studies in English (level B2), 2 - 8 op

Voimassaolo: 01.08.2008 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuyksikkö: Languages and Communication
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

Ei opintojaksokuvauksia.

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, Finnish and English. Students are using German in Exams etc.

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 in all faculties.

Students of the Oulu University of Applied Sciences (OAMK) students and OAMK's international and exchange students may also participate to this cross-institutional study. The quota principle is as follows: at least two OAMK students in a course and if there are more places, they are filled according to the queuing principle.

See more information https://www.oulu.fi/forstudents/crossinstitutionalstudy.

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:

The course with this code will be available last time in 2020-2021.
Registration in WebOodi or Tuudo. 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 in autumn term (1 group). Please note: Intermediate Course in German 2 and Intermediate Course in German 1 can be studied in the way that first Course 2 can be taken in spring and after that Course 1 in autumn term.

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 in all faculties.

Students of the Oulu University of Applied Sciences (OAMK) students and OAMK's international and exchange students may also participate to this cross-institutional study. The quota principle is as follows: at least two OAMK students in a course and if there are more places, they are filled according to the queuing principle.

See more information https://www.oulu.fi/forstudents/crossinstitutionalstudy.

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:

The course with this code will be available last time in 2020-2021.

Registration in WebOodi or Tuudo. 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.
Please note: Intermediate Course in German IV and Intermediate Course in German III can be studied in a way that first Course IV can be taken in spring term and after that Course III in autumn term.

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:

Contact-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 in all faculties.

Students of the Oulu University of Applied Sciences (OAMK) students and OAMK's international and exchange students may also participate to this cross-institutional study. The quota principle is as follows: at least two OAMK students in a course and if there are more places, they are filled according to the queuing principle.

See more information https://www.oulu.fi/forstudents/crossinstitutionalstudy.

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:

The course with this code will be available last time in 2020-2021.

Registration in WebOodi or Tuudo. If the registration has closed the student can sign up by contacting the teacher by e-mail.

A431125: Intermediate Studies, Process Engineering, 60 op

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

Ei opintojaksokuvauksia.

Intermediate studies

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: Elina Jääskä
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:

Period 1.

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:

Web-based teaching 20 hours / practices 14 hours / Independent studying 100 hours.

Learning activities and teaching methods:

Web-based lectures 20 h / exercises 14 h / self-study 100 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 seven mandatory weekly assignments.

Grading:

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

Person responsible:

MSc (Tech.) Elina Jääskä

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.

477221A: Material and Energy Balances, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Marja Mikola

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay477231A Material and Energy Balances I (OPEN UNI) 2.0 op

ay477232A Material and Energy Balances II (OPEN UNI) 3.0 op

ay477221A Material and Energy Balances (OPEN UNI) 5.0 op

477201A 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. Multiunit cases are also considered.

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, minor subject students in relevant disciplines.

Prerequisites and co-requisites:

High school level chemistry, mathematics and physics.

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:

Reklaitis, G.V.: Introduction to Material and Energy Balances. John Wiley & Sons, 1983. ISBN 0-471-041319.

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.

Person responsible:

Juha Ahola

Other information:

This course replaces the course 477201A Material and Energy Balances, 5 ects.

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' and 'Material and Energy Balances' 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.

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. 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., Okiishi, T.H., Huebsch W.W. & Rothmayer A.P. Fluid Mechanics, 7. painos, Wiley 2013. ISBN 978-1-118-318676

or
Gerhart, Gerhart, Hochstein 2017. Munson's Fluid Mechanics. ISBN 978-1-119-24898-9.

Assessment methods and criteria:

This course utilizes continuous assessment. During the course there are 3 intermediate exams in Finnish. 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

477323A: Mass and Heat Transfer, 5 op

Voimassaolo: 01.08.2019 -

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:

477322A	Heat and Mass Transfer	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 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:

Welty J.R., Rorrer G.L. & Foster D.G. Fundamentals of Momentum, Heat and Mass Transfer, International student version, 6. painos, Wiley 2015,ISBN 978-1-118-80887-0, parts 14-28.

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:

Replaces the course 477322A Lämmön ja aineensiirto, 5 ects.

477120A: Fluid and Particle Engineering, 5 op

Voimassaolo: 01.08.2020 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisa Koivuranta

Opintokohteen kielet: Finnish

Leikkaavuudet:

477121A	Particle Technology	5.0 op
477122A	Bulk Solids Handling	5.0 op

Ei opintojaksokuvauksia.

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: Marja Mikola

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 about 30 h, exercises about 10 h and self-study about 90 h.

Target group:

Bachelor students in process and environmental engineering, minor subject students

Prerequisites and co-requisites:

Objectives of Material and Energy Balances and Thermodynamic Equilibrium

Recommended optional programme components:

-

Recommended or required reading:

Lecture handouts
Levenspiel, O.: Chemical Reaction Engineering. John Wiley & Sons, 1972. or newer (parts)
Atkins, P.W.: Physical Chemistry, Oxford University Press, 2002. 7. edition or newer (parts)

Assessment methods and criteria:

Two midterm exams during the course, which can be replaced with final exam after the course and two exercises.

Grading:

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

Person responsible:

Marja Mikola

Working life cooperation:

No

Other information:

-

477427A: High temperature processes, 5 op

Voimassaolo: 01.08.2020 -

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:

477416S	High temperature processes	5.0 op

Ei opintojaksokuvauksia.

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 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

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). Graphical and statistical analysis of experimental data. Correlation, regression and variance analysis.

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:

Homework and written/oral test. 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

491101P: Introduction to mining, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Mining School

Arvostelu: 1 - 5, pass, fail

Opettajat: Saija Luukkanen

Opintokohteen kielet: Finnish

ECTS Credits:

5 cr

Language of instruction:

Finnish. Materials possibly partly in English.

Timing:

Autumn term, period 1

Learning outcomes:

After completing the course student can explain the various stages of mine value chain from exploration until the final concentrate. A student understands economical, social and environmental aspects of sustainable mining.

Contents:

Different stages of mine development: exploration, environmental aspects, geochemical and geophysical measurements, basics in mining engineering and mineral processing.

Mode of delivery:

Face to face teaching

Learning activities and teaching methods:

Lectures, practicals, final exam

Target group:

Bachelor's students in mining engineering and mineral processing, geosciences and process engineering

Recommended or required reading:

Online materials presented during the lectures

Assessment methods and criteria:

Final exam, practicals, activity

Grading:

5-1/failed

Person responsible:

Prof. Saija Luukkanen

477004A: Practical Training, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Saara Luhtaanmäki

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS, 2 months working full-time

Language of instruction:

Finnish or English

Timing:

Student usually works during the summer time.

Learning outcomes:

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

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

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.

A433127: Process and Environmental Engineering, Module preparing for the Option / Process Engineering, 40 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Process Engineering

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:

-

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:

Examination. The course can be completed with three 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 https://www.oulu.fi/forstudents/assesment-criteria.

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

488212A: Fundamentals of catalysis, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Esa-Matti Turpeinen

Opintokohteen kielet: Finnish

Leikkaavuudet:

488309A	Biocatalysis	5.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

Finnish

Timing:

Implementation in spring semester during 3rd period.

Learning outcomes:

After completing this course, a student learns fundamentals of homogenous catalysis, heterogeneous catalysis and biocatalysis. The student understands phenomena occurring in catalysis. The student knows the most important preparation and characterization methods. The student recognizes catalytic applications. The student will be able to define what biocatalysts are, is able to describe how they are produced and give examples how biocatalysts are applied. 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.

Contents:

Thermodynamic and kinetic fundamentals of catalysis. Principles of heterogeneous catalysis. Preparation and characterization of catalysts. Catalytic materials. Deactivation of catalysts. Applications of heterogeneous catalysis.
Microbes and enzymes as biocatalysts, production of biocatalysts, and the use of them in industry. The structure and function of enzymes, enzymatic reactions and basics of enzyme kinetics.

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

Lectures / self-study

Target group:

Bachelor students in process and environmental engineering.

Prerequisites and co-requisites:

Thermodynamic equilibria
Reactor analysis
Basic Principles in Chemistry

Recommended or required reading:

Luentomateriaali;
Atkins P. & De Paula J. Atkins's Physical Chemistry, Oxford University Press, 8th edition, 2006 (tai jokin muu painos).
Gates B.C. Catalytic Chemistry, John Wiley&Sons, Singapore, 1992.
Cornils B. & Herrmann; W.A. (Eds.), Applied Homogeneous Catalysis with Organometallic Compounds, VCH, Weinheim, 1996.
Madigan M.T., Martinko, J.M. & Parker J. Brock Biology of Micro-organisms. Prentice Hall, 13. tai uudempi painos. 978-0-321-73551-5
Illanes A. (ed.): Enzyme Biocatalysis - Principles and Applications. Springer. 978-90-481-7854-4
Aittomäki, E. ym.: Bioprosessitekniikka. WSOY 2002. 951-26995-6
Prins R., Wang A. & Li X: Introduction to heterogeneous Catalysis. World Scientific Publishing Ltd, 2016.

Assessment methods and criteria:

Lectures, intermediate exams (välikokeet) or final examination. Grade will be composed of intermediate exams (välikokeet) or final examination.

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: https://www.oulu.fi/forstudents/assesment-criteria

Person responsible:

Jouni Pursiainen, Esa Turpeinen, Johanna Panula-Perälä ja Satu Pitkäaho.

Working life cooperation:

No

Other information:

Course replaces the course 488309A Biocatalysis, 5.0 ECTS.

488054A: Introduction to Bioproduct and Bioprocess engineering, 5 op

Voimassaolo: 01.08.2021 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488052A	Introduction to Bioproduct and Bioprocess engineering	5.0 op
488052A	Introduction to Bioproduct and Bioprocess engineering	5.0 op

Ei opintojaksokuvauksia.

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: Ahola, Juha Lennart
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:

The student is able to identify the activities of process design and the know-how needed at different design stages. The student is capable of utilising process synthesis and analysis tools for creating a preliminary process concept and pointing out the techno-economic performance of the process concept 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 applicable for preliminary process and plant design.

Mode of delivery:

Lectures and process design exercises in groups.

Learning activities and teaching methods:

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

Target group:

Bachelor students in Process and Environmental Engineering.

Prerequisites and co-requisites:

Objectives of 477202A Reactor analysis and 477304A Separation processes.

Recommended optional programme components:

-

Recommended or required reading:

Lecture handouts, Seider, W.D., Seader, 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 a final exam or two midterm exams and group 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:

Jukka Hiltunen ja Enso Ikonen

Working life cooperation:

No

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: Ikonen, Mika Enso-Veitikka

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

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: Aki Sorsa

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 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:

No course requirements.

Recommended optional programme components:

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

Recommended or required reading:

Lecture handout and other material distributed at the lecture.

Recommended for supplementary literature: Luyben, W.L.: Process Modeling, Simulation and Control for Chemical Engineers. McGraw-Hill cop., New York 1990, 725 p.

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:

Aki Sorsa

Working life cooperation:

No

A433126: Process and Environmental Engineering, Module preparing for the Option /Mineral Processing, 40 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Mineral Processing

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 prerequisites.

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:

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771113P: Introduction to Geology I, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Mining School

Arvostelu: 1 - 5, pass, fail

Opettajat: Kari Strand

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay771113P	Introduction to Geology I (OPEN UNI)	5.0 op

ECTS Credits:

5 credits

Language of instruction:

Finnish

Timing:

1st year autumn

Learning outcomes:

Stdents have an understanding of the basic concepts of the Earth, from its composition and internal *structure* to the geological *processes* that has led to its evolution the present Earth as part of the solar system. They can tell how endogenic processes in the mantle and crust produce magmas and how magmas produce different igneous rock type upon emplacement below and on the Earth's surface. Students are able to recognise and classify common igneous rocks based on their mineral composition and are familiar with common metamorphic rocks and know the metamorphic facies concepts. They can relate deformation and metamorphism of the rocks to plate tectonic processes.

Contents:

Evolution of the Earth as part of the solar system, structure and composition of the Earth. Classification of igneous rocks, magmatism, origin and crystallisation of magmas, volcanism, metamorphism and formation of metamorphic rocks, plate tectonics and deformation structures.

Mode of delivery:

Face to face

Learning activities and teaching methods:

36 h lectures, 6 h exercises

Target group:

1st year geoscience students. The course is a good minor subject course for others.

Prerequisites and co-requisites:

Basic course in mineralogy (771102P) is parallel to this course.

Recommended optional programme components:

This course is intended as an introduction to the scope and methods of igneous and metamorphic petrology.

Recommended or required reading:

Martti Lehtinen, Pekka Nurminen and Tapani Rämö (1998) Suomen kallioperä – 3000 vuosimiljoonaa. Suomen Geologinen Seura, Gummerus Jyväskylä, ISBN 952-90-9260-1, Chapters 2-3. John Grotzinger & Thomas H. Jordan (2010 or 2014) Understanding Earth, 6 th or 7 th edition, Chapters 1-4, 6-7, 9-10, 12.

Assessment methods and criteria:

Written examination and identification test of rock types.

Grading:

5-1/fail

Person responsible:

Kari Strand

Working life cooperation:

No

771117P: Basic course in mineralogy, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Mining School

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Tuisku

Opintokohteen kielet: Finnish

ECTS Credits:

5 ects

Person responsible:

Pekka Tuisku

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:

Examination. The course can be completed with three 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 https://www.oulu.fi/forstudents/assesment-criteria.

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

493300A: Principles of mineral processing, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Oulu Mining School

Arvostelu: 1 - 5, pass, fail

Opettajat: Saija Luukkanen

Opintokohteen kielet: English, Finnish

Leikkaavuudet:

ay493300A	Principles of mineral processing (OPEN UNI)	5.0 op

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish; material mainly in English

Timing:

2nd period in the autumn. Recommended for the 3rd year students.

Learning outcomes:

Upon completion the course the student can explain the main unit process used in ore beneficiation and understands teh main chemical and mineralogical factors palying the key role in process development. The student is able to calculate the most relevant process related calculations, such as mass balances, concentrate recoveris and grindability. The student is aware of the environmental as well as H&S aspects of mineral processing.

Contents:

The main unit processes used in mineral processing. Understanding how the mineralogy and chemistry of the ore influences in the process development.

Mode of delivery:

Mainly face-to-face teaching

Learning activities and teaching methods:

Lectures, demonstrations, assignments

Target group:

Student with mineral processing as major; students of mining engineering, geosciences and process engineering

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

The material provided during the course. B.A. Wills: Mineral processing technology

Assessment methods and criteria:

Final exam, home works and practicals, energy

Grading:

1-5/fail

Person responsible:

Saija Luukkanen

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, Tarja Outila, Heini Postila, Liedes, Hannu Tapani

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 4.

Contents:

Finnish law, EU directives.

Mode of delivery:

Face-to-face teaching and independent work with selected projects.

Learning activities and teaching methods:

Lectures 16 h /seminars 16 h / independent work with project topic. Totally 133 h. The project work are completed as a group work.

Target group:

Students in the bachelor programs of process and environmental engineering, Civil engineering and Architecture.

Recommended or required reading:

Oikeusministeriön oikeudellisen aineiston julkinen Internet-palvelu Finlex soveltuvin osin. (http://finlex.fi). Ympäristöoikeuden pääpiirteet (Ekroos, Kumpula 2010, ISBN: 9789510361283) soveltuvin osin. Maankäyttö- ja rakennuslaki 2000. Opas 10 (ISBN 951-731-249-0 (PDF), URN:ISBN:

9513739767) soveltuvin osin. Maankäyttö- ja rakennuslaki 2000. Opas 11 (ISBN 951-731-250-4 (PDF), URN:ISBN:9513739775) soveltuvin osin. Maankäyttö- ja rakennuslaki 2000. Opas 12. (ISBN 951-731-251-2 (PDF), URN:ISBN:9513739783) soveltuvin osin. soveltuvin osin. Luentomuistiinpanot.

Assessment methods and criteria:

Project report (40%), seminar presentation (40%) 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 teacher Hannu Liedes, University Lecturer Anna-Kaisa Ronkanen and Professor Tarja Outila

Working life cooperation:

The selected project topic is relating to true environmental projects.

Other information:

774311A: A Basic Course in Geochemistry, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Oulu Mining School

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

5 cr

Language of instruction:

The language of instruction is Finnish. The course can also be completed in English as a book examination.

Timing:

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

Learning outcomes:

Opintojakson suoritettuaan opiskelija:

- osaa määritellä geokemian eri osa-alueet,
- omaa yleiskuvan siitä, kuinka alkuaineiden käyttäytymistä luonnossa säätelevät fysiko-kemialliset prosessit ja alkuaineiden elektronirakenteet erot ovat aikojen kuluessa saaneet aikaan maapallon erilaistumisen eri kehiin ja vaikuttavat alkuaineiden käyttäytymiseen geologisissa prosessissa,
- osaa muuttaa geokemiallista analyysiaineistoa muodosta toiseen (esim. painoprosenteista molekyyliosuuksiksi), osaa sijoittaa analyysiaineistoa erilaisille diagrammeille, ja
- kykenee suorittamaan yksinkertaisia laskuja koskien massatasapainoa ja mineraalien saostumis- ja liukenemisreaktioita.

Contents:

Geochemistry as a field of science; history of geochemistry; tasks and fields of geochemistry; origin and electron configuration of chemical elements; origins and structure of the Earth; meteorites; the geochemical classification of the elements; composition of earth's different spheres; geochemical differentiation; composition of magmas; dissolution and precipitation of minerals; pH-Eh-diagrams; introduction to isotope geochemistry.

Mode of delivery:

Face to face teaching

Learning activities and teaching methods:

32 h lectures, 12 h exercises

Target group:

All students in geosciences, and mining engineering and mineral processing

Prerequisites and co-requisites:

A basic course in chemistry

Recommended optional programme components:

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

Recommended or required reading:

Gill, Robin (1996) Chemical Fundamentals of Geology, Chapman & Hall, London, 298 p. Additional material will be given during the lectures.

Assessment methods and criteria:

Examination in both theory and calculations

Grading:

The course utilizes a numerical grading scale 1-5. The grade is calculated as the average of the marks of two exams. Zero stands for a fail.

Person responsible:

Pertti Sarala

493302A: Chemical phenomena in mineral processes, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Oulu Mining School

Arvostelu: 1 - 5, pass, fail

Opettajat: Saija Luukkanen

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS / 133 hours of work

Language of instruction:

Finnish, course material in English

Timing:

The course is held in the autumn semester, during period 2. It is recommended to complete the course at the 3rd study year

Learning outcomes:

Upon succesfull completion student can explain physical-chemical phenomenons (especially surface and electro chemical) affecting various unit operations in mineral processing. Student can also describe general phases in mineral processing and unit operation from standpoint of physical chemistry.

Contents:

Reaction equilibria, basic equations in thermodynamics; chemical interactions especially at interfaces; electrochemical interactions, effects of chemical phenomena on the unit operations of mineral processing.

Mode of delivery:

Face to face teaching

Learning activities and teaching methods:

32 h lectures and excercises (homework)

Target group:

Students in mining engineering and mineral processing, geosciences or process engineering

Prerequisites and co-requisites:

493300A Principles of Mineral Processing

Recommended or required reading:

Lectures and electronic materials

Assessment methods and criteria:

Final exam, homework exercises, activity

Grading:

1-5/fail

Person responsible:

Prof. Saija Luukkanen, lecturer Docent Jaakko Leppinen

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.

477994A: Maturity Test / Bachelor of Science in Process Engineering Technology, 0 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuykiskkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

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:
This course is not offered in English. It is only Finnish-speaking students.
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 Moodle 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

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.

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

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:

Saara Luhtaanmäki

Working life cooperation:

Older students tell their working life experience.

031010P: Calculus I, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Applied Mathematics and Computational Mathematics

Arvostelu: 1 - 5, pass, fail

Opettajat: Pauliina Uusitalo

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 will be lectured also in English.

Timing:

Fall, period 1

Learning outcomes:

Upon completion of the course, the student
- knows how to solve inequalities and equations with absolute value
- identifies the concepts of vector algebra
- can use vector algebra for solving the problems of analytic geometry
- can explain basic characteristics of elementary functions
- is able to analyse the limit and the continuity of the real valued functions of one variable
- can analyse the local minima and maxima of a function
- knows how to find the derivative for a function given with parametric representation
- is able to evaluate the basic calculation of the complex numbers and can rewrite a complex number in its exponential form
- knows the connection between the integral and area
- knows integral techniques such as integration by parts, a substitution method and a partial fraction composition
- can solve problems associated with the differential and integral calculus of the real valued functions of one variable.

Contents:

- Inequalities and absolute value
- Vector algebra and analytic geometry
- Concept of the function and elementary functions
- Monotonicity of the function, the inverse function
- Limit values
- Derivative as limit value of the difference quotient. Derivatives of elementary functions
- The extreme values of a function
- Parameter presentation of the curve, polar coordinates, complex numbers
- Integral function and definite integral, applications
- Integration by parts, substitution method and integration of rational functions

Mode of delivery:

Blended learning, course material is in Moodle learning environment

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:

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:

The course is completed with mid-term exams or a final exam. When completed with mid-term exams, exercise assignments are part of the continuous 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 0-5. In the numerical scale zero stands for a fail.

Person responsible:

Pauliina Uusitalo

Working life cooperation:

The course does not contain working live 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:

-

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: Pauliina Uusitalo

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:

Online 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. The exams are remote exams. It is possibility to take exams also at the university.
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:

Pauliina Uusitalo

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:

Online 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. The exams are remote exams. It is possibility to take exams also at the university.
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:

-

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:

Online teaching, Stack/Moodle digital learning environment

Learning activities and teaching methods:

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

Target group:

1. year students of engineering, 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:

Recommended 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:

No

761118P: Mechanics 1, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Field of Physics

Arvostelu: 1 - 5, pass, fail

Opettajat: Aku Venhola

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 2-14. Also older and newer 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: Two midterm exams or final examination
761118P-02: Two laboratory exercises.

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Aku Venhola

Working life cooperation:

No work placement period

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 ECTS 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 and reports.

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, Biology: optional.

Prerequisites and co-requisites:

Basic Principles in Chemistry (780120P, 5 cr) or General and Inorganic Chemistry A (780117P, 5 cr).
Student is allowed to participate to the course simultaneously when participating the prerequisites.
Attendance at the lecture of Safety in laboratory is compulsory.

Recommended optional programme components:

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

Recommended or required reading:

Instruction Book (in Finnish)

Assessment methods and criteria:

Accomplishment of the course requires accepted preparatory problems, laboratory exercises and problems related to them.

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.

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 ECTS 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.: Organic Chemistry: A Short Course, 10. ed. or newer, Houhgton Mifflin, Boston, 1999; Hart, H. ja Hart, D.: Study Guide & Solutions Book, Organic Chemistry: A Short Course, 10. ed. or newer, Houghton Mifflin, Boston, 1999 and material in Moodle.

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

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 / tasks and 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:

Group work 0-5, the assessment of the tasks will be informed at the beginning of the course.

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.

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 credit / 27 hours of work

Language of instruction:

Finnish

Timing:

Architecture 3. spring semester, period III;
biochemistry 3. autumn semester;
biology 3. autumn semester, period I;
chemistry 3. autumn semester, period I;
civil engineering 2. spring semester, period IV;
computer science and engineering 2. spring semester, period IV;
electronics and communications engineering 3. spring semester;
geosciences 2. spring semester, period IV;
geography 3. semester, periods I and III;
industrial engineering and management 3. year;
information processing sciences 1. or 3. 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;
Master's degree students in industrial engineering and management 1st year.

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 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.

Recommended optional programme components:

In biochemistry the course is completed as a part of 740376A Bachelor's Thesis.

Recommended or required reading:

Web learning material Tieteellisen tiedonhankinnan opas

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

Choose 2 courses

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

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

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 ECTS credits / 134 hours of work

Language of instruction:

Finnish

Timing:

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

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.

Grading:

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

Person responsible:

Minna Tiainen

Working life cooperation:

No

521141P: Elementary Programming, 5 op

Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Computer Science and Engineering DP
Arvostelu: 1 - 5, pass, fail
Opettajat: Mika Oja
Opintokohteen kielet: Finnish
Leikkaavuudet:

ay521141P	Elementary Programming (OPEN UNI)	5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 ECTS Cr

Language of instruction:

Lectures and learning material are in Finnish. The course is not available English.

Timing:

Fall, periods 1-2.

Learning outcomes:

1. Is capable of solving problems in the computer's terms

2. Understands the basic concepts of programming

3. Knows the basics of the Python programming language

4. Is able to implement programs independently

5. Is able to use the internet to find information about programming

Contents:

Problem solving with programming, basic concepts of programming, writing Python code.

Mode of delivery:

Web-based teaching + face-to-face teaching

Learning activities and teaching methods:

30h of exercise groups, 105h self-studying in the web.

Target group:

1 st year students of computer science and engineering, electrical engineering, medical and wellness technology and industrial and engineering management, 2nd year students of physics, and other students of the University of Oulu

Prerequisites and co-requisites:

None.

Recommended optional programme components:

The course provides a basis for subsequent programming courses.

Recommended or required reading:

Web material in an online learning environment. Address will be announced at the beginning of the course.

Assessment methods and criteria:

The course is completed by passing all learning assignments, programming exercises and a final exercise project. Read more about assessment criteria at the University of Oulu webpage
Read more about assessment criteria at the University of Oulu webpage.

Grading:

pass/fail.

Person responsible:

Mika Oja

Working life cooperation:

-

Other information:

The course learning platform is Lovelace (lovelace.oulu.fi)

811104P: Programming 1, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Information Processing Science DP

Arvostelu: 1 - 5, pass, fail

Opettajat: Lappalainen, Jouni Esko Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay811104P	Programming 1 (OPEN UNI)	5.0 op
811122P	Introduction to Programming	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

Finnish

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 of the Bachelor's studies.

Learning outcomes:

After completion of this course, the student will be able to:
* create simple working programs
* identify and use the basic control structures of a program.
* identify the concepts of modularity, table, storage of information.
* apply the concepts of modular structure, tables and information storage techniques into a program.
* find and fix errors in the program.

* solve a computational problem by using abstraction and stepwise refinement
* explain the concept of recursion.
* operate with binary and hexadecimal number systems, as well as knows the presentation of numbers on a computer.
* document the program.

Contents:

1. Software design method (waterfall) 2. Problem solving 3. Stepwise refinement 4. Control structures 5. Modular programming, calling modules, communication between modules 6. Data types 7. Arrays 8. Pointers 9. Character strings 10. Data structures 11. Storing data.

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

Theory studies at lectures and/or online (in Finnish) 40h, programming exercises in a computer lab and/or an online learning environment 24h, self-study 70h

Target group:

BSc students

Recommended or required reading:

Deitel, Deitel: C HOW TO PROGRAM; Pearson Education Inc. 2007, or a newer edition. Lecture slides.

Assessment methods and criteria:

1. Final exam and exercise points and programming assignment. OR 2. Mid-term exams (2) and exercise points and home programming assignment.

Grading:

Numerical scale 1-5 or fail

Person responsible:

Jouni Lappalainen

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:

This course is only for Finnish speaking students with CEFR-level A2 in Swedish language. University of Oulu, Languages and Communication unit don’t offer Beginners courses in Swedish.

Recommended optional programme components:

-

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

Proficiency level:

The course is intended for the students who´s schooling language is Swedish. See 900081Y Second Official Language (Finnish), Written Skills.

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,
- evaluate your own strengths and weaknesses in English-language communication, with a view to developing appropriate skills in future.

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 own 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 / independent work 29 hours. Lessons include regular pair and group work in class. Independent homework activities include team work for the preparation of four short presentations, vocabulary study and other small assignments. Active participation is essential.

Target group:

Students in the engineering programmes: TTK (PO1, YMP1, KO1, TuTa1, RaKy), 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.
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:

-

902141Y: Oral Fluency, 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 Level: B2 (Lower - Average)

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 the 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. Check the study guide for availability in your department.

Learning outcomes:

Learning outcomes - By the end of the course, you are expected to:
1. demonstrated oral fluency for dealing with a wide variety of work-related and social situations,
2. demonstrated an ability to express your own thoughts and opinions in paired or small group discussions,
3. demonstrated understanding of others' contributions in paired or small group discussions,
4. initiated self-directed language learning strategies, including personal goal-setting and self-evaluation, to help you learn effectively in future.

Contents:

Designed for students with weaker self-confidence as English-speakers, this course aims to facilitate the development of oral fluency. The lessons offer extensive speaking practice in pairs and small groups, activating passive knowledge of vocabulary and structure, and helping you gain confidence in your English speaking and listening skills.
This module offers a comfortable environment in which to practice speaking over a wide range of different oral communication activities, including simulations, role-play, improvised or guided situational dialogue, and free conversation. You will also develop your English communication skills and language learning strategies through self-directed homework activities, on which you will report regularly in class, as well as in a final written report at the end of the semester.

Mode of delivery:

Contact teaching and independent study

Learning activities and teaching methods:

Lessons 26 hours. Active participation is essential.
Independent work 27 hours.

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 will be provided by the teacher in electronic form.

Assessment methods and criteria:

Continuous assessment will be based on on the learning outcomes of the course, as demonstrated in a) active participation in oral activities in class and b) the quality of the written homework.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Pass/Fail

Person responsible:

Susan McAnsh - See contact teachers

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. Check the study guide for availability in your department.

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 online 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 online course 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 and TST).

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:

Susan McAnsh

Working life cooperation:

-

Other information:

-

902144Y: Environmental Issues, 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 ECTS credits. The workload is 53 hours.

Language of instruction:

English

Timing:

The course takes place in spring (periods 3 and 4) semester.

Learning outcomes:

By the end of the module, you are able to

- use a comprehensive vocabulary related to environmental matters,
- discuss environmental issues with a reasonable degree of fluency,

- give clear, well-structured and audience-friendly presentations on topics related to the environment.

Contents:

This course focuses on language skills you need to discuss environmental matters, with particular focus on vocabulary development and presentation skills.
The subject matter for the course will draw on interdisciplinary materials, and you will increase your knowledge of up-to-date environmental topics. You will be required to consider controversial issues and be prepared to contribute your own opinions in debate within the class, as well as giving three short presentations to a small group of participants.

Mode of delivery:

Contact teaching and independent study

Learning activities and teaching methods:

Lessons 26 hours / independent work 27 hours. Lessons include regular pair and group work in class. Independent work includes the preparation of three short presentations (18 hours), as well as other independent homework activities (9 hours). Active participation is essential.

Target group:

Students in the engineering programmes (TTK and TST), particularly students of Environmental Engineering.

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), particulary students of the Environmental Engineering.

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. Students must give three short presentations demonstrating the skills specified in the learning outcomes.
Read more about assessment criteria at the University of Oulu webpage.

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
(Alla 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 teachers 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. Check the study guide for availability in your department.

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 four basic areas:
i) business communication
ii) social and cultural aspects of 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:

Susan McAnsh

Working life cooperation:

-

Other information:

See contact teachers, https://www.oulu.fi/kielikoulutus/node/56574.)

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. Check the study guide for availability in your department.

Learning outcomes:

By the end of the course, you are expected to
1) explain and apply general academic / scientific vocabulary from Coxhead's Academic Word List (AWL)
2) differentiate between informal (non-academic) and formal / academic language,
3) demonstrate use of academic vocabulary in a variety of writing and communication contexts.

Contents:

The general aim of this course is 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 (AWL). During this process, you will become aware of the strategies which best promote your skills to learn and memorise vocabulary. 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 work on various 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 a written academic essay or report; vocabulary tests; presentations, which will be given in class to small groups of students; and other homework assignments. 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. Satisfactory completion of the in-class/ homework assignments and the vocabulary tests is required.
See more about assessment criteria, https://www.oulu.fi/forstudents/assesment-criteria.

Grading:

Pass/Fail

Person responsible:

Susan McAnsh. See contact teachers, https://www.oulu.fi/kielikoulutus/node/56574.

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, you work independently, studying online handouts and consolidating your 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) each term in a classroom on the Linnanmaa campus.
Lue lisää opintosuoritusten arvostelusta yliopiston verkkosivulta.

Grading:

Pass/Fail

Person responsible:

Susan McAnsh - See contact teachers

Working life cooperation:

-

Other information:

The course will be organized by online tutoring.
You can enroll for the exam only if you have been accepted for the MoW course during this semester (so enroll first) or in the last two years (do not re-enroll).
You cannot take the exam without registering.
Acceptance information for the course will be sent to your university email address, so make sure your university email address is up to date in WebOodi.
Please, contact the teacher directly if you have any questions about the exam or any other subject related to the course.
Note! Registration for each test separately -> Exams begin on the hour and last 120 minutes.

902121Y: Other Studies in English (level B2), 2 - 8 op

Voimassaolo: 01.08.2008 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Languages and Communication

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Voidaan suorittaa useasti: Kyllä

Ei opintojaksokuvauksia.

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, Finnish and English. Students are using German in Exams etc.

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 in all faculties.

Students of the Oulu University of Applied Sciences (OAMK) students and OAMK's international and exchange students may also participate to this cross-institutional study. The quota principle is as follows: at least two OAMK students in a course and if there are more places, they are filled according to the queuing principle.

See more information https://www.oulu.fi/forstudents/crossinstitutionalstudy.

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:

The course with this code will be available last time in 2020-2021.
Registration in WebOodi or Tuudo. 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 in autumn term (1 group). Please note: Intermediate Course in German 2 and Intermediate Course in German 1 can be studied in the way that first Course 2 can be taken in spring and after that Course 1 in autumn term.

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 in all faculties.

Students of the Oulu University of Applied Sciences (OAMK) students and OAMK's international and exchange students may also participate to this cross-institutional study. The quota principle is as follows: at least two OAMK students in a course and if there are more places, they are filled according to the queuing principle.

See more information https://www.oulu.fi/forstudents/crossinstitutionalstudy.

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:

The course with this code will be available last time in 2020-2021.
Registration in WebOodi or Tuudo. 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.
Please note: Intermediate Course in German IV and Intermediate Course in German III can be studied in a way that first Course IV can be taken in spring term and after that Course III in autumn term.

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:

Contact-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 in all faculties.

Students of the Oulu University of Applied Sciences (OAMK) students and OAMK's international and exchange students may also participate to this cross-institutional study. The quota principle is as follows: at least two OAMK students in a course and if there are more places, they are filled according to the queuing principle.

See more information https://www.oulu.fi/forstudents/crossinstitutionalstudy.

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:

The course with this code will be available last time in 2020-2021.

Registration in WebOodi or Tuudo. If the registration has closed the student can sign up by contacting the teacher by e-mail.

A432125: Intermediate Studies, Environmental Engineering, 60 op

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

Ei opintojaksokuvauksia.

Intermediate Studies

488210A: Environmental science and technology, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Väisänen, Virpi Maria
Opintokohteen kielet: Finnish
Leikkaavuudet:

488201A	Environmental Ecology	5.0 op

488505A: Waste managemet and recycling, 5 op

Voimassaolo: 01.09.2018 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jenni Ylä-Mella, Eva Pongracz
Opintokohteen kielet: Finnish
Leikkaavuudet:

488130A	Waste management and resources recovery	5.0 op

ECTS Credits:

5 cr/133 hours of work

Language of instruction:

English

Timing:

Spring, period 3-4.

Learning outcomes:

After completing the course, the student will be familiar with the waste legislation and other policy instruments and is able to use the waste-related terminology. The student understands the responsibilities of the different actors and stakeholders in the municipal waste management system and knows the key waste minimization and recycling requirements. The student will also be familiar with the municipal waste collection system for households and able to calculate the recycling and recovery rates of recyclables. The student knows the key recycling technologies for the main waste fractions and can calculate treatment costs for the major streams.

Contents:

Waste legislation in the EU and Finland. Waste Act and Regulations, waste hierarchy. Sorting of household waste: waste containers, collection points, transport and reception, responsibilities. Waste recycling and energy recovery technologies, recycling rates, producer responsibility schemes, utilization of bio-waste and energy recovery technologies. Waste Center operations, safe disposal of waste. Consumer habits, consumers responsibilities and future challenges in waste management.

Mode of delivery:

Distance learning, starting 22.1.2021 in zoom. More detailed instructions for those who registered by e-mail on 21.1.2021. Lectures, lecture assignments and an exercise in Moodle. The course has compulsory assignment requirements and the course evaluation will be based on the grades of intermediate tasks. No exam.

Learning activities and teaching methods:

Online and video lectures; lecture assignments and an exercise as a personal work.

Target group:

Master's students of process and environmental engineering; Bachelor's students of environmental engineering; Minor subject students.

Recommended or required reading:

Video lectures and information on recommended reading material will be provided during the course.

Assessment methods and criteria:

Continuous evaluation. Completion of all personal lecture assignments and the exercise during the course are mandatory.

Grading:

The evaluation is based on personal lecture assignments and an exercise during the course. Each intermediate task must be passed, and the scores obtained from assignments forms the final grade. The course uses a numerical grading scale 1-5. In the numerical scale, zero stands for a fail.

Person responsible:

D.Sc.(Tech.) Jenni Ylä-Mella

Other information:

This course replaces the course 488130A Waste management and resources recovery.
The course can also be taken in Finnish in autumn term period 1. (See the course desription in Finnish.)

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' and 'Material and Energy Balances' 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.

477221A: Material and Energy Balances, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Marja Mikola

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay477231A	Material and Energy Balances I (OPEN UNI)	2.0 op
ay477232A	Material and Energy Balances II (OPEN UNI)	3.0 op
ay477221A	Material and Energy Balances (OPEN UNI)	5.0 op
477201A	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. Multiunit cases are also considered.

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, minor subject students in relevant disciplines.

Prerequisites and co-requisites:

High school level chemistry, mathematics and physics.

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:

Reklaitis, G.V.: Introduction to Material and Energy Balances. John Wiley & Sons, 1983. ISBN 0-471-041319.

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.

Person responsible:

Juha Ahola

Other information:

This course replaces the course 477201A Material and Energy Balances, 5 ects.

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. 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., Okiishi, T.H., Huebsch W.W. & Rothmayer A.P. Fluid Mechanics, 7. painos, Wiley 2013. ISBN 978-1-118-318676
or
Gerhart, Gerhart, Hochstein 2017. Munson's Fluid Mechanics. ISBN 978-1-119-24898-9.

Assessment methods and criteria:

This course utilizes continuous assessment. During the course there are 3 intermediate exams in Finnish. 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

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: Marja Mikola

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 about 30 h, exercises about 10 h and self-study about 90 h.

Target group:

Bachelor students in process and environmental engineering, minor subject students

Prerequisites and co-requisites:

Objectives of Material and Energy Balances and Thermodynamic Equilibrium

Recommended optional programme components:

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Recommended or required reading:

Lecture handouts
Levenspiel, O.: Chemical Reaction Engineering. John Wiley & Sons, 1972. or newer (parts)
Atkins, P.W.: Physical Chemistry, Oxford University Press, 2002. 7. edition or newer (parts)

Assessment methods and criteria:

Two midterm exams during the course, which can be replaced with final exam after the course and two exercises.

Grading:

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

Person responsible:

Marja Mikola

Working life cooperation:

No

Other information:

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477323A: Mass and Heat Transfer, 5 op

Voimassaolo: 01.08.2019 -

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:

477322A	Heat and Mass Transfer	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 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:

Welty J.R., Rorrer G.L. & Foster D.G. Fundamentals of Momentum, Heat and Mass Transfer, International student version, 6. painos, Wiley 2015,ISBN 978-1-118-80887-0, parts 14-28.

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:

Replaces the course 477322A Lämmön ja aineensiirto, 5 ects.

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). Graphical and statistical analysis of experimental data. Correlation, regression and variance analysis.

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:

Homework and written/oral test. 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

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:

Examination. The course can be completed with three 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 https://www.oulu.fi/forstudents/assesment-criteria.

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

488212A: Fundamentals of catalysis, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Esa-Matti Turpeinen

Opintokohteen kielet: Finnish

Leikkaavuudet:

488309A	Biocatalysis	5.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

Finnish

Timing:

Implementation in spring semester during 3rd period.

Learning outcomes:

After completing this course, a student learns fundamentals of homogenous catalysis, heterogeneous catalysis and biocatalysis. The student understands phenomena occurring in catalysis. The student knows the most important preparation and characterization methods. The student recognizes catalytic applications. The student will be able to define what biocatalysts are, is able to describe how they are produced and give examples how biocatalysts are applied. 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.

Contents:

Thermodynamic and kinetic fundamentals of catalysis. Principles of heterogeneous catalysis. Preparation and characterization of catalysts. Catalytic materials. Deactivation of catalysts. Applications of heterogeneous catalysis.
Microbes and enzymes as biocatalysts, production of biocatalysts, and the use of them in industry. The structure and function of enzymes, enzymatic reactions and basics of enzyme kinetics.

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

Lectures / self-study

Target group:

Bachelor students in process and environmental engineering.

Prerequisites and co-requisites:

Thermodynamic equilibria
Reactor analysis
Basic Principles in Chemistry

Recommended or required reading:

Luentomateriaali;
Atkins P. & De Paula J. Atkins's Physical Chemistry, Oxford University Press, 8th edition, 2006 (tai jokin muu painos).
Gates B.C. Catalytic Chemistry, John Wiley&Sons, Singapore, 1992.
Cornils B. & Herrmann; W.A. (Eds.), Applied Homogeneous Catalysis with Organometallic Compounds, VCH, Weinheim, 1996.
Madigan M.T., Martinko, J.M. & Parker J. Brock Biology of Micro-organisms. Prentice Hall, 13. tai uudempi painos. 978-0-321-73551-5
Illanes A. (ed.): Enzyme Biocatalysis - Principles and Applications. Springer. 978-90-481-7854-4
Aittomäki, E. ym.: Bioprosessitekniikka. WSOY 2002. 951-26995-6
Prins R., Wang A. & Li X: Introduction to heterogeneous Catalysis. World Scientific Publishing Ltd, 2016.

Assessment methods and criteria:

Lectures, intermediate exams (välikokeet) or final examination. Grade will be composed of intermediate exams (välikokeet) or final examination.

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: https://www.oulu.fi/forstudents/assesment-criteria

Person responsible:

Jouni Pursiainen, Esa Turpeinen, Johanna Panula-Perälä ja Satu Pitkäaho.

Working life cooperation:

No

Other information:

Course replaces the course 488309A Biocatalysis, 5.0 ECTS.

477004A: Practical Training, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Saara Luhtaanmäki

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS, 2 months working full-time

Language of instruction:

Finnish or English

Timing:

Student usually works during the summer time.

Learning outcomes:

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

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

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.

Choose the Other

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: Elina Jääskä

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:

Period 1.

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:

Web-based teaching 20 hours / practices 14 hours / Independent studying 100 hours.

Learning activities and teaching methods:

Web-based lectures 20 h / exercises 14 h / self-study 100 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 seven mandatory weekly assignments.

Grading:

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

Person responsible:

MSc (Tech.) Elina Jääskä

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.

485021A: Construction Contracting, 5 op

Voimassaolo: 01.08.2018 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Civil Engineering field

Arvostelu: 1 - 5, pass, fail

Opettajat: Liedes, Hannu Tapani

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

ECTS Credits:

5 ECTS

Language of instruction:

Finnish

Person responsible:

Hannu Liedes

Other information:

This Course replaces courses 466113S and 488119A.

A433128: Process and Environmental Engineering, Module preparing for the Option / Environmental Processing, 40 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Study module

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Environmental Engineering

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 24 h, exercises 16 h and independent work 93 h. Totally 133 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.

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, Tarja Outila, Heini Postila, Liedes, Hannu Tapani

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 4.

Contents:

Finnish law, EU directives.

Mode of delivery:

Face-to-face teaching and independent work with selected projects.

Learning activities and teaching methods:

Lectures 16 h /seminars 16 h / independent work with project topic. Totally 133 h. The project work are completed as a group work.

Target group:

Students in the bachelor programs of process and environmental engineering, Civil engineering and Architecture.

Recommended or required reading:

Oikeusministeriön oikeudellisen aineiston julkinen Internet-palvelu Finlex soveltuvin osin. (http://finlex.fi). Ympäristöoikeuden pääpiirteet (Ekroos, Kumpula 2010, ISBN: 9789510361283) soveltuvin osin. Maankäyttö- ja rakennuslaki 2000. Opas 10 (ISBN 951-731-249-0 (PDF), URN:ISBN: 9513739767) soveltuvin osin. Maankäyttö- ja rakennuslaki 2000. Opas 11 (ISBN 951-731-250-4 (PDF), URN:ISBN:9513739775) soveltuvin osin. Maankäyttö- ja rakennuslaki 2000. Opas 12. (ISBN 951-731-251-2 (PDF), URN:ISBN:9513739783) soveltuvin osin. soveltuvin osin. Luentomuistiinpanot.

Assessment methods and criteria:

Project report (40%), seminar presentation (40%) 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 teacher Hannu Liedes, University Lecturer Anna-Kaisa Ronkanen and Professor Tarja Outila

Working life cooperation:

The selected project topic is relating to true environmental projects.

Other information:

488211A: Environmental engineering in industry and municipalities, 5 op

Voimassaolo: 01.08.2019 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Huuhtanen, Mika Ensio
Opintokohteen kielet: Finnish

ECTS Credits:

5 ETCS / 135 hours of work

Language of instruction:

Finnish

Timing:

In period 4.

Learning outcomes:

The student is able to define different methods and techniques to control and reduce environmental loads from industrial and municipality sectors.
He/she is able to explain main specific characters, challenges and driving forces in the field. The student can describe the environmental impacts on air, water and soil, and methods and technological solutions to reduce these.

Contents:

Control and mitigation of environmental load from industry and communities taking into account their specific characteristics and challenges. Economical and administrative steering instruments and actions. Environmental engineering solutions and applications in control of soil, water and air environmental load. Sustainable utilization of materials and natural sources based on circular economy approach.

Mode of delivery:

Contact lectures, group works, report

Learning activities and teaching methods:

Lectures 24h, group work 8h, self studies 103 h

Target group:

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

Prerequisites and co-requisites:

Course 488210A Ympäristötiede ja -teknologia is recommended.

Recommended optional programme components:

The course is pre-requirement for Environmental Engineering study programme Master’s courses.

Recommended or required reading:

Materials delivered via the Moodle environment.

Assessment methods and criteria:

Written mid-exams and a group work report.

Read more about the course assessment and grading systems of the University of Oulu at https://www.oulu.fi/forstudents/assesment-criteria

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

485301A: Basics of Geotechnics, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Civil Engineering field

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

488115A	Geomechanics	5.0 op

ECTS Credits:

5 ECTS credits / 135 hours of work

Language of instruction:

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 fundamentals 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, bearing capacity of foundations, 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 (10 h) also independent work (95 h)

Target group:

Students in Bachelor programs of civil engineering and environmental 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.

Assessment methods and criteria:

Examination

Grading:

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

Person responsible:

Anne Tuomela

Working life cooperation:

No

Other information:

This course will replace course 488115A Geomechanics in Academic year 2020-21.

488208A: Basics of production and use of energy, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: Finnish

Leikkaavuudet:

488202S	Production and Use of Energy	5.0 op

781309A: Environmental Chemistry, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Chemistry

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay781309A	Environmental Chemistry for Chemistry Teachers	5.0 op
780373A	Environmental Chemistry	3.0 op
780316A	Environmental Chemistry	2.0 op
780355A	Environmental Chemistry and Hazardous Wastes	4.0 op
780359A	Environmental Chemistry	4.0 op
780360A	Environmental Chemistry and Hazardous Wastes	5.5 op

ECTS Credits:

5 ECTS credits / 134 hours of work

Language of instruction:

Finnish, in English as a book examination

Timing:

The course is held in the spring semester

Learning outcomes:

Upon completion the student should have acquired an understanding of chemistry of atmosphere, hydrosphere and terrestrial environment. The student should have understanding of twelve principles of green chemistry. After the course the student is acquainted with the limitations of the use of dangerous chemicals and is able to find updated information of them.

Contents:

Fundamentals of environmental chemistry; chemistry of the soil, natural and waste waters and atmosphere, circulation of chemical compounds in the nature, chemical releases, environmentally toxic and other noxious compounds, environmental analytics and basics of physical measurements. Environmental friendly chemistry. The principles of green chemistry with examples of real life.

Mode of delivery:

Blended teaching

Learning activities and teaching methods:

Book examination 134 h of studying

Target group:

Chemistry, optional

Prerequisites and co-requisites:

General and Inorganic Chemistry A (780117P) or Basic Principles in Chemistry (780120P).

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:

van Loon, G.W. & Duffy, S.J.: Environmental Chemistry, A Global Perspective, Oxford, 2000; Lancaster M.: Green Chemistry: An introductory text, RSC, 2002.

Assessment methods and criteria:

Book examination

Grading:

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

Person responsible:

Minna Tiainen

Working life cooperation:

No

488213A: Sources and control of air pollution, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Satu Pitkäaho

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay488204S	Air Pollution Control Engineering (OPEN UNI)	5.0 op
488204S	Air Pollution Control Engineering	5.0 op

ECTS Credits:

5 ECTS

Language of instruction:

Finnish

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, CO2) and is able to design air pollution cleaning devices.

Contents:

Atmosphere and air pollutants. Air pollution effects and regulations. Emission measurements. General ideas in air pollution control.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h, exercises 12 h, homework 8 h and self-study 85 h.

Target group:

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

Recommended or required reading:

de Nevers; N.: Air Pollution Control Engineering. 2nd ed. McCraw-Hill 2000. 586 s.

Assessment methods and criteria:

Written final exam or intermediate exams.

Grading:

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

Person responsible:

Satu Pitkäaho ja Esa Turpeinen

Other information:

Lectured for the first time in academic year 2021-22.

488053A: Enviromental monitoring and analysis, 5 op

Voimassaolo: 01.08.2019 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Heini Postila

Opintokohteen kielet: Finnish

ECTS Credits:

5 ETCS credits/133 hours of work

Language of instruction:

Finnish

Timing:

This is new course, which will teach firs time in Spring Term 2022.

Learning outcomes:

The aim of the course is to give comprehensive understanding on nutrient and pollutant loads to the environment (soil, water and air) caused by human activities (industry, land use, communities). During the practical part of the course, the students will learn how to take samples from water, soil and air and what are common mistakes/errors in sampling. After completing the course, the students are able to name common pollutants and know how concentrations are measured and analyzed. Furthermore, the student can calculate and estimate loads to the environment using available data and common methods according to the environmental authorities and common requirements.

Contents:

Typical nutrients and pollutants, that has impacts on environment and are typically monitored, common methods how nutrients and pollutants are measured and analyzed, calculation of nutrients and pollutant loads (discharge/runoff, concentration, annual variation etc.), commonly used estimation methods for annual load calculation (unit hydrograph, specific load etc.)

Mode of delivery:

Face-to-face teaching and groupwork together with other students.

Learning activities and teaching methods:

Lectures (28 h), guiding in groupwork (4 h) and independent work (101 h). Totally 133 h.

Target group:

Students in bachelor study program 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: 488142A Environmental legislation and EIA.

Recommended optional programme components:

-

Recommended or required reading:

Lecture hand-outs and other materials delivered in lectures.

Assessment methods and criteria:

Report and presentation from groupwork, lecture exam.

Grading:

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

Person responsible:

Researcher Heini Postila

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.

488994A: MaturityTest/Bachelor of Science in Environmental Engineering/Technology, 0 op

Voimassaolo: 16.03.2007 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

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:
This course is not offered in English. It is only Finnish-speaking students.
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 Moodle 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

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

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, Ville-Hermanni Sotaniemi

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. 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 488212A Fundamentals of Catalysis, or respective knowledge in biocatalysis.

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 with potential web learning.

Grading:

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

Person responsible:

Elisa Koivuranta, Ville Sotaniemi

Working life cooperation:

No

Other information:

The course replaces earlier courses 488302A Basics of Biotechnology 5 etcs ja 477103A Pulp and Paper Technology 3 etcs.