

Opasraportti

FTech - Courses in English for exchange students, Field of Process and Environmental Engineering (2019 - 2020)

Courses in English for exchange students at the Faculty of Technology in the study fields of Process Engineering and Environmental Engineering

This Course Catalogue lists courses taught in English that are available for exchange students at the Faculty of Technology / Process Engineering and Environmental Engineering during academic year 2019-20.

When preparing your study plan please use the information provided under the **Courses tab** in this catalogue. Read carefully the information of each course you wish to take (language of instruction, target group, course content, timing, preceding studies, additional information etc.).

For information on the exchange application process please see www.oulu.fi/university/studentexchange. All exchange applicants must submit their exchange application through SoleMOVE by the deadline given, proposed study plan is attached to the on-line application.

Accepted exchange students are required to register to all courses. Course registration takes place once you have received your University of Oulu login information, this takes place close to the start of your exchange period. When registering you will be able to find detailed information on teaching and schedule under **Instruction** tab.

Teaching periods for 2019-20

Autumn term 2019

Period 1: Sept 2 - Oct 25, 2019

Period 2: Oct 28 – Dec 20, 2019

Spring term 2020

Period 3: Jan 7 – March 6, 2020

Period 4: March 9 – May 8, 2020

For arrival and orientation dates see www.oulu.fi/university/studentexchange/academic-calender

Any questions on courses at the Faculty of Technology should be addressed to:

M.Sc. Marita Puikkonen
Faculty International Coordinator
for Student Exchange
Incoming & Outgoing Mobility
Faculty of Technology, University of Oulu,
Finland
Email: Study.Technology(at)oulu.fi

Further information on application process and services for incoming exchange students:
www.oulu.fi/university/studentexchange or international.office(at)oulu.fi

Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

488305S: Advanced Course for Biotechnology, 5 op
 477223S: Advanced Process Design, 5 op
 477311S: Advanced Separation Processes, 5 op
 488214S: Air Pollution Control Engineering - Practical Solutions, 5 op
 477508S: Automation in Metallurgical Industry, 5 op
 477713S: Automation in Mineral Processing, 5 op
 900013Y: Beginners' Finnish Course 1, 3 op
 900053Y: Beginners' Finnish Course 2, 5 op
 488321S: Bioreactor technology, 5 op
 477204S: Chemical Engineering Thermodynamics, 5 op
 477209S: Chemical Process Simulation, 5 op
 477123S: Chemical processing of biomasses, 5 op
 477128S: Circular Bioeconomy, 5 op
 477525S: Computational intelligence in automation, 5 op
 900054Y: Conversational Skills in Finnish, 3 op
 488507S: Energy Systems Engineering, 5 op
 488201A: Environmental Ecology, 5 op
 488216S: Environmental Engineering Project, 5 op
 477502A: Experiment design and analysis, 5 op
 488127S: Field measurements, site investigations and geotechnical tests, 5 op
 477305S: Flow Dynamics, 5 op
 477052A: Fluid Mechanics, 5 op
 488504S: Fundamentals of nuclear energy, 5 op
 488140S: Groundwater modelling and management, 5 op
 488134S: Hydrogeology and groundwater engineering, 5 op
 488102A: Hydrological Processes, 5 op
 488203S: Industrial Ecology, 5 op
 488136S: Integrated water resources management, 5 op
 900015Y: Intermediate Finnish Course 1, 5 op
 900016Y: Intermediate Finnish Course 2, 5 op
 488052A: Introduction to Bioproduct and Bioprocess engineering, 5 op
 477323A: Mass and Heat Transfer, 5 op
 477221A: Material and Energy Balances, 5 op
 477124S: Mechanical processing of biomasses, 5 op
 477506S: Modelling and Control of Biotechnical Processes, 5 op
 477308S: Multicomponent Mass Transfer, 5 op
 477306S: Non-ideal Reactors, 5 op
 477203A: Process Design, 5 op
 477524S: Process Optimization, 5 op
 477309S: Process and Environmental Catalysis, 5 op
 477501A: Process dynamics, 5 op
 488209S: Renewable Energy, 5 op
 477312S: Science and Professional Ethics, 5 op
 477304A: Separation Processes, 5 op
 477523S: Simulation, 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
 900027Y: Special Course in Finnish: Writing Skills, 3 op
 488137S: Statistical hydrology, 5 op
 900017Y: Survival Finnish, 2 op
 488402S: Sustainable Development, 5 op
 488506S: Sustainable Urban Energy, 5 op
 477415S: Thermodynamic and process modelling in metallurgy, 5 op

488141S: Urban hydrology, 5 op

488110S: Water and Wastewater Treatment, 5 op

Opintojaksojen kuvaukset

Tutkintorakenteisiin kuulumattomien opintokokonaisuuksien ja -jaksojen kuvaukset

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 36 h / homework 48 h / self-study 51 h.

Target group:

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

Prerequisites and co-requisites:

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

Recommended optional programme components:

-

Recommended or required reading:

Will be announced at the lectures.

Assessment methods and criteria:

Lectures, exercises and report. Grade will be composed of homework exercises and reports or final examination.

Grading:

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

Person responsible:

Johanna Panula-Perälä

Working life cooperation:

No

Other information:

-

477223S: Advanced Process Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ahola, Juha Lennart

Opintokohteen kielet: English

Leikkaavuudet:

477206S Advanced Process Design 6.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

Timing:

Spring, periods 3 and 4

Learning outcomes:

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

Contents:

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

Mode of delivery:

Design projects in small groups

Learning activities and teaching methods:

Project meetings 10h and project group work 120h

Target group:

Master's students of process and environmental engineering

Prerequisites and co-requisites:

Learning outcomes of 477203A Process Design or similar knowledge

Recommended or required reading:

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

Assessment methods and criteria:

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

Grading:

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

Person responsible:

University Lecturer Juha Ahola

Working life cooperation:

No

Other information:

-

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 2nd period every odd year

Learning outcomes:

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

Contents:

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

Mode of delivery:

Face-to-face teaching and seminars.

Learning activities and teaching methods:

Lectures 30 h, seminar work 25 h, 78 h

Target group:

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

Prerequisites and co-requisites:

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

Recommended optional programme components:

-

Recommended or required reading:

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

Assessment methods and criteria:

Portfolio or written examination and a seminar work including reporting and presentation.

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

Grading:

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

Person responsible:

Professor Riitta Keiski

Working life cooperation:

No

Other information:

-

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 2021.

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 optional programme components:

-

Recommended or required reading:

Materials in the Optima environment. de Nevers; N.: Air Pollution Control Engineering. 2nd ed. McCraw-Hill 2000. 586 pp

Additional literature: Singh, H. B.: Composition, Chemistry, and Climate of the Atmosphere. New York 1995. 527 pp.; Bretschneider, B. & Kurfurst, J.: Air Pollution Control Technology. Elsevier, Amsterdam 1987. 296 pp.; Hester, R. E. & Harrison, R. M.: Volatile Organic Compound in the Atmosphere. Issues in Environmental Science and Technology. Vol. 4. Bath 1995; Hester, R. E. & Harrison, R. M.: Waste Incineration and the Environment. Issues in Environmental Science and Technology. Vol 4. Bath 1995.

Assessment methods and criteria:

Written final exam or intermediate exams.

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

Grading:

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

Person responsible:

Satu Pitkäaho ja Esa Turpeinen

Working life cooperation:

No.

Other information:

Korvaa lukuvuonna 2019-2020 kurssin 488204S Air Pollution Control Engineering.

477508S: Automation in Metallurgical Industry, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jari Ruuska

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

Timing:

Implementation in the 4th period (spring term)

Learning outcomes:

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

Contents:

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

Mode of delivery:

Lectures, practical group work using simulators

Learning activities and teaching methods:

Lectures during one period

Target group:

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

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

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

Assessment methods and criteria:

Continuous evaluation: lectures, lecture diaries, test, and practical work using simulation.

Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

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

Person responsible:

Jari Ruuska

Working life cooperation:

No

Other information:

-

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

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

Timing:

Implementation in the 4th period (spring term)

Learning outcomes:

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

Contents:

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

Mode of delivery:

Lectures and demonstrations

Learning activities and teaching methods:

Lectures during one period

Target group:

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

Prerequisites and co-requisites:

Basic knowledge in minerals processing and control engineering.

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes in English

Assessment methods and criteria:

Continuous evaluation: lectures and test

Grading:

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

Person responsible:

Aki Sorsa

Working life cooperation:

No

Other information:

-

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:

A1.2

Status:

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

Required proficiency level:

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

ECTS Credits:

3 ECTS credits

Language of instruction:

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

Timing:

Learning outcomes:

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

Contents:

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

The topics and communicative situations covered in the course are: talking about oneself, one's family, studies and daily routines, as well as asking about these things from other person, expressing opinions, describing people and things, talking about weather and seasons, the names of the months and colours.

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

Mode of delivery:

Contact teaching and guided self study

Learning activities and teaching methods:

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

Target group:

International degree and post-graduate degree students and exchange students of the University

Prerequisites and co-requisites:

Completion of the Survival Finnish Course

Recommended optional programme components:

-

Recommended or required reading:

Gehring, S. & Heinzmann, S. Suomen mestari 1 (chapters 3 - 5)

Assessment methods and criteria:

Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.

Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

Grading scale is 1-5.

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

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

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:

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

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: asking for and giving directions, asking for help/favours, carrying out transactions in shops and restaurants, talking about the past, asking for and expressing opinions and feelings, accommodation, travelling, vehicles, work, professions, food, drink and parties.

The structures studied are: the local cases, nominative plural (basic form plural), imperfect (past tense of verbs), part of the imperative, more declension types for nouns (word types), more about the change of the consonants k, p and t in verbs and nouns, declension of the demonstrative pronouns and personal pronouns, more about the partitive case, basics of the object cases, postpositions and some sentence types in Finnish.

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 and exchange students of the University

Prerequisites and co-requisites:

Completion of the Beginners' Finnish Course 1

Recommended optional programme components:

-

Recommended or required reading:

Gehring, S. & Heinzmann, S.: **Suomen mestari 1** (kappaleet 6-9)

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:

Anne Koskela

Working life cooperation:

-

Other information:

Sign-up in WebOodi. The lessons will be held **twice a week** during a 13-week period.

488321S: Bioreactor technology, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Petri Tervasmäki

Opintokohteen kielet: English

Leikkaavuudet:

488304S Bioreactor Technology 6.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

Timing:

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

Learning outcomes:

After completing this course, the student will be able to verbally describe the most common equipment, materials and methods related to biotechnological processes, microbial growth and cultivation and sterilization. The student will be able to 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. The student will also be able to analyze and interpret data from bioprocesses.

Contents:

Biotechnological process: General process schemes, batch, fed-batch and continuous processes, biocatalysts and raw materials. Reactor design and instrumentation. Sterilization: kinetics of heat inactivation and practical implementation of sterilization methods. Mathematical description and quantification of the function of biocatalysts. Monod and 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 6 h / homework 27 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 488309A Biocatalysis, 488052A Introduction to Bioproduct and Bioprocess Engineering) or respective knowledge.

Recommended optional programme components:

-

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 concepts. 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:

Petri Tervasmäki

Working life cooperation:

No

Other information:

-

477204S: Chemical Engineering Thermodynamics, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jani Kangas

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

Finnish

Timing:

Period 1 (autumn term)

Learning outcomes:

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

Contents:

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

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 46 h and self-study 87 h

Target group:

Students in the study options Process Design and Chemical Engineering

Prerequisites and co-requisites:

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

Recommended or required reading:

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

Assessment methods and criteria:

Combination of examinations and exercises

Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

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

Person responsible:

Dr Jani Kangas

Working life cooperation:

No

Other information:

-

477209S: Chemical Process Simulation, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jani Kangas

Opintokohteen kielet: English

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

Timing:

Autumn, periods 1-2

Learning outcomes:

The student has the ability to convert a process flow diagram into a form compatible with process simulation software. She/he has skills to evaluate realistic process conditions in a typical chemical process. The student can

apply proper thermodynamic property models for simulation purposes. She/he can name the advantages and disadvantages of using the sequential modular solving approach in chemical process modelling and simulation. She/he is capable of solving a computer simulation case for a typical chemical process. The student is able to analyze the simulation results with respect to realistic values.

Contents:

The main functional parts of a process simulator. Thermodynamic property models and databanks. Degrees of freedom analysis. Steady-state simulation. Sequential modular, and equation-oriented approaches in simulation. Numerical solving methods. 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:

-

477123S: Chemical processing of biomasses, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisa Koivuranta

Opintokohteen kielet: English

Leikkaavuudet:

477104S Chemical Processing of Biomasses 3.0 op

ECTS Credits:

5 ECTS /133 h of work

Language of instruction:

English

Timing:

Implementation in autumn period 1

Learning outcomes:

Upon completion of the course, a student should be able to explain the value chain of chemical processing of renewable lignocellulosic raw materials to pulp and different end-products. A student is able to identify lignocellulosic raw material sources, their properties, their main components and utilization potential of components. The student also identifies the unit operations of chemical pulping processes, can explain their operational principles and their objectives in the process and their role in end product properties. Besides

cellulose fibre production, the student identifies biorefining concepts of chemical pulp components (cellulose, hemicelluloses, lignin and extractives) into high value products; cellulose derivatives, special fibres, nanofibrillar and micronized celluloses, and green chemicals.

Contents:

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

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

The implementation methods of the course vary. Lectures and exercises max. 36 h, web learning and self-study 97 h. A part of the teaching can be replaced by group work or home work.

Target group:

Students interested in bioeconomy.

Prerequisites and co-requisites:

488052A Introduction to Bioproduct and Bioprocess Engineering is recommended.

Recommended optional programme components:

-

Recommended or required reading:

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

Assessment methods and criteria:

This course utilizes continuous assessment including 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/assessment-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:

-

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	Recycled Fiber Processes	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 optional programme components:

-

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.

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 recognizes the key problems of the data-driven modelling and is able to choose suitable solutions which ensure generalization. The student is able to explain the operation principles of genetic algorithms and to use them in tuning of fuzzy set systems and neural network models. Moreover, the student is able to describe alternative solutions for dynamic models, hyperplane methods and hybrid solutions. The student can explain the key concepts of cellular automata and evolutionary computation. After the course the student is able to search other relevant programming tools.

Contents:

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

Mode of delivery:

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

Learning activities and teaching methods:

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

Target group:

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

Prerequisites and co-requisites:

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

Recommended optional programme components:

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

Recommended or required reading:

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

Assessment methods and criteria:

The assessment of the course is based on the exercises, case study, seminar and the final report. Final exam is an alternative for the final report.

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

Grading:

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

Person responsible:

D.Sc. (Tech.) Esko Juuso

Working life cooperation:

No

Other information:

-

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 of University of Oulu.

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 once 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

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.

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 intermediate 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

488201A: Environmental Ecology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Väisänen, Virpi Maria

Opintokohteen kielet: English

Leikkaavuudet:

488210A	Environmental science and technology	5.0 op
ay488201A	Environmental Ecology (OPEN UNI)	5.0 op
488406A	Introduction to Environmental Science	5.0 op
480001A	Environmental Ecology	5.0 op

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

English

Timing:

This course is not in timetables anymore. You can accomplish the course in period 4 in spring 2020 (contact the person responsible).

Learning outcomes:

Upon completion of the course, the student is able to define the basic concepts of environmental ecology and environmental conservation. He/she has knowledge about the state of the environment and is able to explain the essential environmental problems and the main effects of pollution. In addition, the student knows some solutions to environmental problems and is aware of ethical thinking in environmental engineering. The student also has basic knowledge about environmental toxicology.

Contents:

Principles of environmental ecology. Global and regional environmental problems and their effects. Principles of environmental toxicology. Engineering and environmental ethics.

Mode of delivery:

e-learning

Learning activities and teaching methods:

Individual e-learning 133 h following the schedule of the course.

Target group:

Bachelor's degree students of environmental engineering. International exchange students.

Recommended optional programme components:

-

Recommended or required reading:

Chiras D.: Environmental Science. New York, Jones and Bartlett Publishers, 9th edition, 2013.

Assessment methods and criteria:

Continuous assessment is implemented in the course and all learning tasks are evaluated. All students complete the course in a final examination. The assessment of the course is based on the learning outcomes of the course. Read more about the course assessment and grading systems of the University of Oulu at www.oulu.fi/english/studying/assessment.

Grading:

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

Person responsible:

University teacher Virpi Väisänen

Working life cooperation:

No

Other information:

-

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:

Team work and interactive seminars.

Learning activities and teaching methods:

135 h team work, 20 h seminars.

Target group:

Master's degree students.

Prerequisites and co-requisites:

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

Recommended optional programme components:

-

Recommended or required reading:

To be announced.

Assessment methods and criteria:

Team report 75 % and individual assignments 25 %.

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.

Other information:

-

477502A: Experiment design and analysis, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Aki Sorsa

Opintokohteen kielet: Finnish

Leikkaavuudet:

470432A Process Control Engineering II 5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

Finnish

Timing:

Implementation in the 4th period on the spring term

Learning outcomes:

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

Contents:

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

Mode of delivery:

Lectures and extensive exercise work

Learning activities and teaching methods:

Lectures during one period

Target group:

Bachelor's students in process and environmental engineering

Prerequisites and co-requisites:

Course Process Dynamics is recommended beforehand

Recommended optional programme components:

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

Recommended or required reading:

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

Assessment methods and criteria:

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

Grading:

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

Read more about [assessment criteria](#) at the University of Oulu webpage.

Person responsible:

Aki Sorsa

Working life cooperation:

No

Other information:

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

488127S: Field measurements, site investigations and geotechnical tests, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ali Torabi Haghighi

Opintokohteen kielet: English

Leikkaavuudet:

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

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

The course unit is given during periods 1 and 2

Learning outcomes:

Upon completion the student should be able to design field measurements and understand the quality of sampling and measurements in the field of environmental engineering. The student also improves skills of working in a team of fellow students to share expertise and execution responsibilities. The student understands the laboratory testing procedures and the associated parameters that help in estimating the soil mechanics and Geotechnical engineering and. The student knows how to use different methods for field measurement and sampling in water and geotechnical issues. The student can take considering the safety during the laboratory works and field measurements. After the course, the student can write detailed engineering reports.

Contents:

In the lectures: Units of measurements, error and mistake in laboratory works and field measurements, random and systematic error, precision and accuracy in laboratory work, planning field works, description of measuring site, securing results and material, sample preservation, subsoil exploration, direct & indirect methods of exploration, disturb and undisturbed samples, safety in field work, introduction on surveying, levelling, map and scale, different tests in soil mechanics laboratory.

Laboratory works in soil mechanics and geotechnical engineering: sieving test, hydrometer test, Atterberg limits test, proctor test, direct shear box test and oedometer test.

In the field: Working with GPS. Levelling and collecting data for preparing topography map. Soil sampling, surface water and groundwater sampling, Measuring velocity and discharge of river by using current meter and tracer.

Mode of delivery:

Face-to-face teaching, laboratory working

Learning activities and teaching methods:

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

Target group:

Master students in the Water and Geo Engineering and Water and Environment study options

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488115A Geomechanics

Recommended optional programme components:

-

Recommended or required reading:

Field measurements and Laboratory work instruction, lecture materials

Assessment methods and criteria:

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

Grading:

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

Person responsible:

University Teacher Ali Torabi Haghighi

Working life cooperation:

No

Other information:

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 <https://www.oulu.fi/forstudents/assessment-criteria>.

Person responsible:

Docent Dr Esa Muurinen

Working life cooperation:

No

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 3rd period. It is recommended to complete the course at the second (Bachelor's) spring semester.

Learning outcomes:

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

Contents:

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

Mode of delivery:

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

Learning activities and teaching methods:

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

Target group:

Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:

Knowledge of solving differential equations.

Recommended optional programme components:

The course is part of a stream that aims at skills needed in the phenomenon-based modelling and planning of industrial processes.

Recommended or required reading:

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

Assessment methods and criteria:

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

Grading:

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

Person responsible:

University teacher Kaisu Ainassaari

Working life cooperation:

No

Other information:

-

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 Caló

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.

488140S: Groundwater modelling and management, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pertti Ala-Aho

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

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

Learning outcomes:

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

Contents:

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

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

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

Target group:

Master students in the water engineering orientation of the Environmental Engineering program

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488134S Hydrogeology and groundwater engineering, 031022P Numerical Methods

Recommended or required reading:

Lecture handouts, Physical and Chemical Hydrogeology (Domenico PA, Schwartz FW, 2nd edition, 1998, ISBN 0-471-59762-7). Maanalaiset vedet - pohjavesigeologi-an perusteet (Korkka-Niemi K, Salonen V-P, 1996, ISBN 951-29-0825-5). Pohjavesi ja pohjaveden ympäristö (Mälkki E, 1999, ISBN 951-26-4515-7).

Assessment methods and criteria:

Modelling assignment, report and presentation for project work.

Grading:

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

Person responsible:

Postdoctoral Researcher Pertti Ala-aho

Working life cooperation:

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

488134S: Hydrogeology and groundwater engineering, 5 op

Voimassaolo: 28.11.2016 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

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

Learning outcomes:

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

Contents:

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

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

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

Target group:

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

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course prior to enrolling for the course unit: 488102A Hydrological Processes

Recommended or required reading:

Lecture handouts, Physical and Chemical Hydrogeology (Domenico PA, Schwartz FW, 2nd edition, 1998, ISBN 0-471-59762-7). Maanalaiset vedet - pohjavesigeologi-an perusteet (Korkka-Niemi K, Salonen V-P, 1996, ISBN 951-29-0825-5). Pohjavesi ja pohjaveden ympäristö (Mälkki E, 1999, ISBN 951-26-4515-7).

Assessment methods and criteria:

exam and/or lecture exams.

Grading:

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

Person responsible:

Postdoctoral Researcher Pekka Rossi

Working life cooperation:

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

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 relation 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 solved in the lectures based on real problems

Other information:

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

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 1st period.

Learning outcomes:

Upon completion of the course, the student will be able to use the tools of industrial ecology and apply them to industrial activity. The student can also analyze the interaction of industrial, natural and socio-economic systems and able to judiciously suggest changes to industrial practice in order to prevent negative impacts. The student can also analyze the examples of industrial symbioses and eco-industrial parks and able to specify the criteria of success for building eco-industrial parks.

Contents:

Material and energy flows in economic systems and their environmental impacts. Physical, biological and societal framework of industrial ecology. Industrial metabolism, corporate industrial ecology, eco-efficiency, dematerialization. Tools of industrial ecology, such as life-cycle assessment, design for the environment, green chemistry and engineering. Systems-level industrial ecology, industrial symbioses, eco-industrial parks.

Mode of delivery:

Face-to-face teaching in English.

Learning activities and teaching methods:

Lectures 30 h / Group work 30 h / Self-study 75 h. The exercises are completed as guided group work.

Target group:

Master's degree students of process and environmental engineering.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes; Graedel T.E & Allenby B.R.: Industrial Ecology. New Jersey: Prentice Hall, 2003.

Assessment methods and criteria:

All students complete the course in a final exam. Also the exercise will be assessed. The assessment criteria are based on the learning outcomes of the course.

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

Grading:

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

Person responsible:

University teacher Virpi Väisänen

Working life cooperation:

No

Other information:

-

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

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).

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 of 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. The lessons will be held twice a week during a 13-week period.

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 of University of Oulu.

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 feast culture 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 twice 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 Intermediate Finnish Course 1 or equivalent skills

Recommended optional programme components:

-

Recommended or required reading:Gehring, S. & Heinzmann, S.: **Suomen mestari 2 (chapters 6 - 9)****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.

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: Ville-Hermanni Sotaniemi, Elisa Koivuranta

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 3rd (Bachelor's) year

Learning outcomes:

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

Contents:

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

Mode of delivery:

Blended teaching.

Learning activities and teaching methods:

Lectures 48 h/ self-study 85 h.

Target group:

Bachelor students in process engineering and environmental engineering.

Prerequisites and co-requisites:

488309A Biocatalysis or respective knowledge in biocatalysis.

Recommended optional programme components:

-

Recommended or required reading:

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

Assessment methods and criteria:

This course utilizes continuous assessment including lecture exams with potential web learning. Alternatively, the course can also be completed by taking the end exam.

Grading:

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

Person responsible:

Elisa Koivuranta, Petri Tervasmäki

Working life cooperation:

No

Other information:

The course replaces earlier courses 488302A Basics of Biotechnology 5 etcs ja 477103A Pulp and Paper Technology 3 etcs.

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:

(Will be announced later)

Assessment methods and criteria:

This course utilizes continuous assessment. During the course there are 4 intermediate exams. The course can also be completed by final examination.

Grading:

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

Person responsible:

University teacher Kaisu Ainassaari

Working life cooperation:

No

Other information:

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: Ahola, Juha Lennart

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.

Mode of delivery:

Lectures and group exercise

Learning activities and teaching methods:

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

Target group:

Bachelor students in of Process or Environmental Engineering

Prerequisites and co-requisites:

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.

477124S: Mechanical processing of biomasses, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisa Koivuranta

Opintokohteen kielet: English

Leikkaavuudet:

477105S	Mechanical Processing of Biomasses	3.0 op
---------	------------------------------------	--------

ECTS Credits:

5 ECTS / 133 h of work

Language of instruction:

English

Timing:

Implementation in autumn period 2

Learning outcomes:

Upon completion of the course, a student should be able to explain the value chain of mechanical and chemimechanical 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 optional programme components:

-

Recommended or required reading:

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

Assessment methods and criteria:

This course utilizes continuous assessment including 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/assessment-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.

Other information:

-

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

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: 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, the student can model kinetics and dynamics of bio-technical processes (mainly fermentation) starting from the process phenomena and mass balance models. He also understands the limitations of different

approaches and the modelling assumptions. He also has preliminary skills to write models in Matlab/Simulink environment.

Contents:

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

Mode of delivery:

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

Learning activities and teaching methods:

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

Target group:

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

Prerequisites and co-requisites:

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

Recommended optional programme components:

-

Recommended or required reading:

Lecture materials.

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) 29-48; Rani, K.Y. & Rao, V.S.R.: Control of Fermenters - a Review. Bioprocess Engineering 21 (1999) 77-88

Assessment methods and criteria:

Grade given is based on home tests and exercise report; ratio is 4/1. Final examination is also possible.

Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

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

Person responsible:

Aki Sorsa

Other information:

-

477308S: Multicomponent Mass Transfer, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

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

Learning outcomes:

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

equilibrium and the methods to estimate the validity of measured values. After completing the course the student is capable of applying models of mass transfer and phase equilibrium to model and design multicomponent processes (e.g. distillation and condensation) based on diffusion.

Contents:

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

Mode of delivery:

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

Learning activities and teaching methods:

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

Target group:

Master's degree students of process and environmental engineering

Prerequisites and co-requisites:

Courses 477303A Mass Transfer or 477322A Heat and Mass Transfer, 477304A Separation Processes and 031019P

Matrix Algebra are recommended beforehand.

Recommended optional programme components:

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

Recommended or required reading:

Taylor, R. & Krishna, R.: Multicomponent Mass Transfer.

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

Assessment methods and criteria:

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

Grading:

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

Person responsible:

Laboratory manager Dr Esa Muurinen

Working life cooperation:

No

477306S: Non-ideal Reactors, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

470222A Reactor Analysis and Design II 5.0 op

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

English

Timing:

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

-

Recommended or required reading:

Fogler, H. Scott: Elements of chemical reaction engineering. (5th edition) 2016. Prentice Hall PTR: Pearson Education International; Nauman, E.B.: Chemical Reactor Design. New York, John Wiley & Sons.1987; Additional literature: Winterbottom, J.M. & King, M.B. (Editors) Reactor Design for Chemical Engineers. Padstow 1999, T.J. International Ltd. 442 s. Gianetto, A. & Silveston, P.L.: Multiphase Chemical Reactors: Theory, Design, Scale-up. Hemisphere, Washington, D. 1986; Froment, G. & Bischoff, K.B.: Chemical Reactor Analysis and Design. New York, John Wiley & Sons. 1990; Hessel, V., Hardt, S. & Löwe, H.: Chemical Micro Process Engineering. Weinheim 2004, Wiley-VHC Verlag GmbH & Co. 674 p, Salmi, T., Mikkola, J.-P. & Wärnå, J. Chemical reaction engineering and reactor technology. Boca Raton 2011, CRC Press, 615 p.

Assessment methods and criteria:

Intermediate exams (2) or final examination.. Homework assignments affect the course grade. Read more about the course assessment and grading systems of the University of Oulu at www oulu.fi/english/studying/assessment.

Grading:

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

Person responsible:

University Lecturer Mika Huuhtanen

Working life cooperation:

No

Other information:

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

477203A: Process Design, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jani Kangas

Opintokohteen kielet: English

Leikkaavuudet:

480310A Fundamentals of Process Design 5.0 op

ECTS Credits:

5 ECTS /133 hours of work

Language of instruction:

English

Timing:

Period 4

Learning outcomes:

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:

-

477524S: Process Optimization, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Aki Sorsa

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay477524S Process Optimization (OPEN UNI) 5.0 op

477504S Process Optimization 4.0 op

ECTS Credits:

5 ECTS /135 hours of work

Language of instruction:

English

Timing:

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

Learning outcomes:

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

Contents:

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

Mode of delivery:

Face-to-face teaching and exercises.

Learning activities and teaching methods:

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

Target group:

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

Prerequisites and co-requisites:

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

Recommended optional programme components:

See prerequisites

Recommended or required reading:

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

Assessment methods and criteria:

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

Grading:

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

Person responsible:

Aki Sorsa

Working life cooperation:

No

Other information:

-

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

Learning outcomes:

Student is capable of specifying the process steps in catalyst design, selection and testing. Student is able to explain the most important industrial catalytic processes, the use of catalysts in environmental technology, catalyst research and the significance of an interdisciplinary approach in the preparation, development and use of catalysts. He/she recognizes the connection between catalysis and green chemistry and the role of catalysis in sustainable processes and energy production.

Contents:

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 40 h, exercises 10 h, homework 20 h, teamwork presentations 10 h, and self-study 53 h.

Target group:

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

Prerequisites and co-requisites:

488212A Katalyyisin perusteet tai 488309A Biokatalyyysi

Recommended optional programme components:

-

Recommended or required reading:

Lecture handout; Richardson, J.T.: Principles of Catalyst Development. New York. 1989, 288 pp.; Janssen, F.J.J. G. & van Santen, R.A.: Environmental Catalysis. NIOK, Catalytic Science Series, Vol. 1. 1999. 369 pp.

Additional literature Ertl, G., Knözinger, J. & Weitkamp, J.: Handbook of Heterogeneous Catalysis. Vol. 1-5.

Weinheim. 1997, 657 p.; Thomas, J.M. & Thomas, W.J.: Principles and Practice of Heterogeneous Catalysis.

Weinheim 1997. 657 pp.; Somorjai, G.A.: Surface Chemistry and Catalysis. New York 1994, 667 pp.; van Santen, R.A., van Leuwen, P.W.N.M., Mouljin, J.A. & Averill, B.A.: Catalysis: An Integrated Approach, 2nd ed. Studies in Surface Science and Catalysis 123. Amsterdam 1999, Elsevier Sci. B.V. 582 pp.

Assessment methods and criteria:

Written examination and homework.

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

Grading:

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

Person responsible:

Satu Pitkäaho and Esa Turpeinen

Working life cooperation:

No

Other information:

-

477501A: Process dynamics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: 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, distillation columns and heat exchangers. Modelling of large-scale processes.

Mode of delivery:

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

Learning activities and teaching methods:

Solving exercise problems; textbook

Target group:

Exchange and other international students (for the English version)

Prerequisites and co-requisites:

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

Recommended optional programme components:

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

Recommended or required reading:

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

Assessment methods and criteria:

Homework and written/oral test

Grading:

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

Person responsible:

Marko Paavola

Working life cooperation:

No

Other information:

-

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

Learning outcomes:

The student is able to define different methods and techniques to generate electricity and heat. He/she is able to explain steam power plant operating principles and is able to compare operation of different kinds of steam power plants. The student can describe the environmental impacts of energy production and is able to compare the environmental impacts of different ways of producing energy. The student is able to identify functioning of the fossil based and renewable energy production systems. He/she is able to explain how the electricity markets work. The student is also able to explain the adequacy of energy reserves.

Contents:

Structure of energy production and consumption. Systems for electric transportation, storing and distribution. Distribution and adequacy of energy resources. Effects of environment contracts on the use of energy resources. Environmental comparison of different energy production methods and fuels. Energy markets. Development views of energy technology.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40h, self-study 95 h

Target group:

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

Prerequisites and co-requisites:

The courses 477011P and 488010P Introduction to Process and Environmental Engineering I and II or 477013P Introduction to Process and Environmental Engineering are recommended.

Recommended optional programme components:

-

Recommended or required reading:

Materials delivered via the Optima environment.

Assessment methods and criteria:

Written final exam.

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

Grading:

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

Person responsible:

University lecturer Mika HUUHTANEN

Working life cooperation:

No

Other information:

This course replaces the course 488202S Production and Use of Energy in academic year 2019-2020.

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@oulu.fi)

Other information:

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

477304A: Separation Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Muurinen, Esa Ilmari

Opintokohteen kielet: Finnish

Leikkaavuudet:

470323A Separation Processes 5.0 op

ECTS Credits:

5 ECTS / 133 hours of work.

Language of instruction:

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

Timing:

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

Learning outcomes:

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

Contents:

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

Mode of delivery:

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

Learning activities and teaching methods:

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

Target group:

Bachelor's degree students of process and environmental engineering.

Prerequisites and co-requisites:

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

Recommended optional programme components:

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

Recommended or required reading:

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

Assessment methods and criteria:

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

Grading:

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

Person responsible:

Laboratory manager Dr Esa Muurinen

Working life cooperation:

No

Other information:

-

477523S: Simulation, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Esko Juuso

Opintokohteen kielet: Finnish

Leikkaavuudet:

477503S Simulation 3.0 op

ECTS Credits:

5 ECTS / 135 hours of work

Language of instruction:

Finnish and English

Timing:

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

Learning outcomes:

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

Contents:

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

Mode of delivery:

Tuition is implemented mainly as face-to-face teaching

Learning activities and teaching methods:

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

Target group:

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

Prerequisites and co-requisites:

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

Recommended optional programme components:

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

Recommended or required reading:

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

Assessment methods and criteria:

The assessment of the course is based on learning diaries, exercises, case study, seminar and the final report. Final exam is an alternative for the final report.

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

Grading:

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

Person responsible:

D.Sc. (Tech.) Esko Juuso

Working life cooperation:

No

Other information:

-

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:

Completing course 488501S is preferred.

Recommended or required reading:

Will be provided during the course by the lecturers.

Chen-Ching Liu, Stephern McArthur and Seung-Jae Lee (eds.)(2016) Smart Grids handbook, 3 volume set, and Stephen F. Bush (2014): Smart Grid: Communication-Enabled Intelligence for the Electric Power Grid.

<http://onlinelibrary.wiley.com/book/10.1002/9781118820216>.

Assessment methods and criteria:

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

Grading:

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

Person responsible:

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

Other information:

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

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 be 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 Kühnlenz

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.

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:

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

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 an Optima environment.

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 Intermediate Finnish Course 2

Recommended optional programme components:

-

Recommended or required reading:

Web based material.

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 by emailing the contact teacher.

488137S: Statistical hydrology, 5 op

Voimassaolo: 28.11.2016 - 31.07.2020

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannu Marttila

Opintokohteen kielet: English

Leikkaavuudet:

488145S Data analysis for Water Resources 5.0 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

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

Learning outcomes:

By completing the course, students will be able to understand and apply most common statistical methods used in hydrology. Students gain experience in using statistical software to solve problems for large hydrological datasets. With the software, students can present their findings with various plots which are conventional in statistical hydrology and water resources management. During the course students will be further familiarized with scientific writing and reporting.

Contents:

Course uses hydrological and meteorological data to cover topics: 1) Summary statistics like mean, maximum, minimum, median, standard deviation and etc. 2) Probability distributions (normal, gamma, log-normal and generalized extreme value) visualized with histograms, box plots, and CDF's and used in recurrence analyses. 3)

Analyzing statistical significance of correlations between hydrological and meteorological variables. 4) Building and visualizing regression models and estimating the validity of the established models. 5) Trend and time series analysis using plots and statistical autoregression models.

Mode of delivery:

Face-to-face teaching, independent assignments

Learning activities and teaching methods:

In total, 135 hours of learning activities consisting of lectures (9 h), instructed computer sessions (18 h), and return assignments (108 h)

Target group:

Master students in the water engineering study options of the Environmental Engineering program

Prerequisites and co-requisites:

The prerequisite is the completion of the following courses: 488102A Hydrological Processes, and 477033A Programming in Matlab or corresponding Matlab skills

Recommended or required reading:

Helsel, D.R., & Hirsch, R.M., 2002. Statistical Methods in Water Resources (available online). Loucks, D.P., van Beek, E., Stedinger, J.R., Dijkman J.P.M., Villars, M.T., 2005. Water Resources Systems Planning and Management (available online).

Assessment methods and criteria:

A) reports of group work on 3 return assignments (each 25% of the final grade), and B) final exam (25% of the final grade))

Grading:

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

Person responsible:

Postdoctoral Researcher Pertti Ala-aho

Working life cooperation:

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

Other information:

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

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 of Oulu University.

Required proficiency level:

No previous Finnish studies.

ECTS Credits:

2 ECTS credits

Language of instruction:

Finnish and English

Timing:

-

Learning outcomes:

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

Contents:

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

vocabulary and grammar, and the main principles of pronunciation.

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

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

Mode of delivery:

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 and exchange students of the University

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Will be provided during the course.

Assessment methods and criteria:

Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.

Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

Grading scale is on a pass/fail basis.

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

Sign-up in WebOodi.

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 performance 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

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:

Periods 1-4, 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

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, Equilibrium 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 prerequisites. 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.

488141S: Urban hydrology, 5 op

Voimassaolo: 28.11.2016 - 31.07.2020

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi

Opintokohteen kielet: English

Leikkaavuudet:

488146S Urban water management 5.0 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

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

Learning outcomes:

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

Contents:

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

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

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

Target group:

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

Prerequisites and co-requisites:

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

Recommended optional programme components:

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

Recommended or required reading:

Lecture handouts, Hulevesiopas (2012, in Finnish)

Assessment methods and criteria:

Examination, seminar and a design exercise.

Grading:

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

Person responsible:

Postdoctoral Researcher Pekka Rossi

Working life cooperation:

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

488110S: Water and Wastewater Treatment, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisangela Heiderscheidt

Opintokohteen kielet: English

Leikkaavuudet:

480151S	Water and Wastewater Treatment	7.0 op
480208S	Industrial Water and Wastewater Treatment	3.5 op

ECTS Credits:

5 ECTS credits/133 hours of work

Language of instruction:

English

Timing:

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

Learning outcomes:

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

Contents:

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

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

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

Target group:

Students in Master program of Environmental Engineering and in master program of civil engineering.

Prerequisites and co-requisites:

The required prerequisite is the completion of the following course or to have corresponding knowledge prior to enrolling for the course unit: Introduction to process and environmental engineering (477013P) or I (477011P) and II (488010P)

Recommended optional programme components:

-

Recommended or required reading:

To be provided during the course.

Assessment methods and criteria:

The course can be completed in two different study modes: A) Active mode: midterm exam based on reading material + completion of 2 group exercises + final exam based on lectures and exercises; B) Passive mode (book exam): 100% self-study mode where the student is provided with 2-3 reference books and attends an exam based on the provided material. (Passive mode can be complete under special 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 first hand how to deal with some of the most common issues related to water and wastewater purification systems.

Other information:

-