

Opasraportti

Department of process and environmental engineering (2011 - 2012)

1.1. Degree programmes in the Department of Process and Environmental Engineering

The department has two degree programmes: Process Engineering and Environmental Engineering.

1.1.1 Bachelor's Degree and Learning Outcomes

During the first three years in both programmes, students study for the Bachelor's Degree in Engineering. The studies in both degrees are uniform for all students. They give very comprehensive basis for the Master's Degree studies, and capabilities to work in basic level tasks of the fields process and environmental engineering.

The bachelor's degree consists of intermediate studies in process or environmental engineering, basic studies in mathematics and natural sciences and studies leading to personal skills and capabilities. The studies are divided into three phases:

1. Descriptive phase: Presents specific phenomena related to process and environmental engineering and mastering them in the level of general descriptions
2. Analytical phase: Widens the scope through modelling
3. Synthetic phase: Emphasizes the planning and development aspects of engineering based on analysing the phenomena and how to master them

The studies for the Bachelor's Degree can be grouped under five separate themes. The learning outcome of each theme emphasizes the skills in basic planning and students' capabilities to enhance their knowledge in Master's and postgraduate phases, which in turn prepare for more demanding planning and development tasks in diverse specialising areas and for independent research.

The themes are:

1. Phenomena-based modelling and planning and related themes
2. Industrial engineering and production
3. Mastering and assessing effects to the environment
4. Mastering automation technology
5. Non-technological skills

1.1.2. Master's Degree and Learning Outcomes

The fourth and fifth year of the programmes consist of studies aiming at Master's Degree and preparing the student for demanding planning, research and development tasks in the fields and gives a strong base for postgraduate studies. Students can choose their option within the field and specialization. Studies consist mainly of advanced studies within the specific area, which is chosen in the spring of the third year.

There are four options in the Degree Programme of Process Engineering:

1. Automation Technology
2. Production Technology
3. Industrial Engineering and Management and Work Science
4. Sustainable Energy

There are three options in the Degree Programme of Environmental Engineering:

1. Water and Geoenvironmental Engineering
2. Industrial Environmental Engineering and Biotechnology
3. Sustainable Energy

Before the students choose their option the department organises an information event that presents the different orientations, their field of research and work situations of graduates. In addition, specialization options may organise their own events.

1.2. Degree Programme in Process Engineering

1.2.1. Aims of the degree programme

The programme aims to prepare creative and cooperative academic professionals in the field of process engineering and continue to educate them to graduates mastering their personal specialisation areas. After completing bachelor's level studies in Process Engineering, the student is familiar with the common natural scientific basis of engineering, the phenomena related to mechanical, chemical and mass and heat transfer processes that are common in industry irrespectively of the type of industry.

After completing master's level studies the student is prepared to plan and develop diverse processes also from the viewpoint of control and optimization and regarding financial and environmental issues. In addition the student is familiar with safety in engineering, ergonomics and human resource aspects.

1.2.2. Professional goals

The Degree Programme in Process Engineering concentrates during its bachelor's studies on the basic tasks in process engineering and during master's studies, the students aim towards the following career paths according to their specialization area:

1. Research, development and planning tasks in processing industry (Production Technology)

2. Research, development and planning tasks related to process automation, optimization of processes, instrumentation of industrial processes and automation systems (Automation Technology)

3. Production management, marketing and finances, tasks developing safety in technology and ergonomics (Industrial Engineering and Management and Work Science)

Graduates with bachelor's or master's degrees from process technology can find jobs within a wide scope of engineering tasks in the industry. They can be employed by a company working in the field process technology (chemical, pulp and paper, mining, metallurgic, food or pharmaceutical industry), a company manufacturing machines and equipment for process technology, consulting agency in the field, a company in the field of automation, various teaching and research institutes and public administration.

1.2.3. Specialization Options and Learning Outcomes

In the end of the third year of their bachelor's studies the students choose their specialization option for the master's studies. They can further specialize within the area by choosing specializations.

Automation Technology: Students become familiar with dynamic behaviour of processes which forms the basis for mastering automation technological aspects of processes and process optimization. In addition students learn about measurement and instrumentation in process industry, methods in automation control and systems engineering and diverse automation systems. The area prepares students for developing into experts in the field of process automation and other application areas of automation. After completing studies in Automation Technology the student is able to control and optimize processes through automation technology.

Production Technology: Students specialize in one or more sub-fields (chemical engineering, pulp and paper industry, mining engineering, process metallurgy). Students can also add to their professional skills by taking advanced studies in environmental engineering, industrial engineering and management, work science or automation technology. There is also a possibility to take study units in mechanical engineering or in other fields the student is interested in, or to deepen the knowledge in mathematics and natural sciences.

After completing studies in Production Technology the students know the processes in the industry of their specialization area, the flows of resources and energy within them and are familiar with their essential control parameters. Students are also able to consider non-ideal situations, several simultaneous phenomena and assess the operations of a process-based industry.

Industrial Engineering and Management and Work Science: Students get a wide understanding of industrial engineering, production business and delivery, and project work. Masters in the field are familiar with managing production processes from the viewpoint of statistical quality assessment and with the principals of undisturbed and safe processes in the industry. The graduates can view humans and work through occupational psychology concepts and have skills in organization and human resource planning, assessment, development and controlling change. They are familiar with managing product development, innovations and technology in a company. In addition the students are able to consider humans as part of the working environment and plan worker-safe environments.

In addition to engineering tasks, graduates of the area can work in production management, product development, marketing and other engineering and financial tasks.

Sustainable Energy: Students master reduction of the environmental burden due to the production and distribution of energy, production of renewable energy and usage of other CO²-neutral energy sources, and methods of saving energy in industry, transportation and building. In addition the students learn to work in multidisciplinary, multicultural and international working environment.

The specialization area is an international option in the department and is taught entirely in English. The first two terms of the programme are studied in the University of Oulu, and the third in the University of Narvik in the northern Norway.

1.3. Degree Programme in Environmental Engineering

1.3.1. Aims of the degree programme

The programme aims to prepare creative and cooperative academic professionals in the field of environmental engineering and continue to educate them to graduates mastering their personal specialisation areas. After completing bachelor's level studies in Environmental Engineering the students are familiar with the common natural science basis of engineering, and have good knowledge of environmental and process engineering and the demands of production. In addition, the graduates are familiar with the legal and financial aspects related to environmental issues and principles of safety and ergonomics in engineering.

Master's level graduates are familiar with the factors and operation models affecting biological, chemical, physical and mechanical processes and methods and techniques related to their planning and development. In addition they have theoretical and practical knowledge of their own specialization area and based on that knowledge, the graduates are prepared to work independently and follow the development of their field.

1.3.2. Professional goals

The Degree Programme in Environmental Engineering concentrates, during its bachelor's studies, on the basic tasks in environmental engineering, and during master's studies the students aim towards the following career paths:

1. Water and waste management in communities, air protection, soil restoration and building environments
2. Water, air and soil protection and waste management in industry and especially in process industry
3. Tasks in biotechnological industries

Bachelors of Environmental Engineering can work in restoration, usage and planning tasks in the field.

Masters of Environmental Engineering can work in food, chemical, pulp and paper, mining, metallurgic industry or in biotechnological industry. Possible are also planning and consulting, teaching and research institutes, public administration. Graduates can work in planning, research, development, teaching, and managerial tasks in their field or as private enterprisers.

1.3.3. Specialization Options and Learning Outcomes

In the end of the third year of their bachelor's studies the students choose their specialization option for the master's studies. The options are: Water and Geoenvironmental Engineering, Industrial Environmental Engineering and Biotechnology and Sustainable Energy. They can also further specialize within the area by choosing specializations.

Water and Geoenvironmental Engineering: Students master natural and manipulated water processes (surface and groundwater, water protection, controlling water systems, flood protection and prevention, dam safety, controlling soil humidity in developed areas and subsurface drainage, water management technology in communities and

industry, managing waste and water flows, waste management and soil protection and restoration. Special attention is paid to prevention and correction of environmental damage and assessing environmental impact. Teaching and research is based on noticing northern aspects.

Graduates are capable of planning and managing projects and processes affecting water and geoenvironment and assess their impact on the environment and health. They can work in planning, usage, maintenance, research and public administration tasks in water system projects, in water management and in geoenvironmental engineering tasks. The focus of teaching is usage and restoration of water systems, water resources and groundwater technology, managing waters and sewage and restoration of contaminated soil and phenomena taking place in the soil. There is also a possibility to specialize through optional studies.

Industrial Environmental Engineering and Biotechnology offers the following specialization areas:

1. Industrial Environmental Engineering prepares for planning environmentally friendly processes through plant specific and other methods. The specialization is based on the viewpoint of process planning and emphasizes process analysis, process assessment and issues related to environmental engineering. Students master the different phases, information sources and methods of typical planning process. Areas of speciality include usage of catalysts in environmental engineering, environmentally-friendly raw materials, production methods and products, and life cycle analysis.

2. Bioprocess Engineering prepares students to work in industry that requires expertise in bioprocess engineering, microbiology and biochemistry and strong know-how in environmental and process engineering. Graduates are capable of applying and managing phenomena related to bioprocess engineering.

Graduates can work in planning, research, development and teaching tasks in the field, or pursue postgraduate studies. They can work in e.g. food, pharmaceutical or other industries, planning and consultation offices, institutes, public administration or private enterprises in the area of biotechnology.

Tutkintorakenteet

Bachelor's degree of Process Engineering

Tutkintorakenteen tila: published

Lukuvuosi: 2011-12

Lukuvuoden alkamispäivämäärä: 01.08.2011

Basic and Intermediate Studies (109.5 op)

The student will learn to apply phenomena-based desing and static and dynamic modelling in the context of process and environmental engineering, as well as to examine physical, chemical, biological and geoscientific phenomena.

A431120: Basic and Intermediate Studies, Process Engineering, 99,5 - 109,5 op

Compulsory

780109P: Basic Principles in Chemistry, 4 op

488011P: Introduction to Environmental Engineering, 5 op

761103P: Electricity and Magnetism, 4 op

761101P: Basic Mechanics, 4 op

780122P: Introductory Laboratory Course in Chemistry, 3 op

780112P: Introduction to Organic Chemistry, 4 op

031010P: Calculus I, 5 op

031017P: Differential Equations, 4 op

031019P: Matrix Algebra, 3,5 op
 031021P: Probability and Mathematical Statistics, 5 op
 031022P: Numerical Analysis, 5 op
 477302A: Heat Transfer, 3 op
 477101A: Fluid and Particle Engineering I, 3 op
 477102A: Bulk Solids Handling, 4 op
 477201A: Material and Energy Balances, 5 op
 477202A: Reactor Analysis, 4 op
 477301A: Momentum Transfer, 3 op
 477303A: Mass Transfer, 3 op
 477304A: Separation Processes, 5 op
 477501A: Process dynamics, 5 op
 477502A: Process Control Engineering II, 5 op
 477011P: Introduction to Process and Environmental Engineering I, 5 op
 477021A: Laboratory Exercises of Process Engineering, 4 op
 477401A: Thermodynamic Equilibria, 5 op
 477402A: Structure of Solid Materials, 5 op
 761121P: Laboratory Exercises in Physics 1, 3 op

Module Preparing for the Option, Module 1 (29 op)

The goal is to learn to perceive industrial production activities as a whole, taking also the technological, economic, juridical and occupational safety and health issues into account.

A431121: Module Preparing for the Option, Module 1, 29 - 40 op

Compulsory

555220P: Basic Course in Industrial Engineering and Management, 3 op
 477001A: Practical Training, 3 op
 555221P: Introduction to Production, 2 op
 555280P: Basic Course of Project Management, 2 op
 555262A: Usability and Safety in Product Development, 3 op
 477203A: Process Design, 5 op
 555260P: Basic Course in Occupational Safety and Wellbeing at Work, 3 op
 555223A: Introduction to Production Control, 3 op
 555263A: Technology, Society and Work, 2 op
 477103A: Pulp and Paper Technology, 3 op

Module Preparing for the Option, Module 2 (21.5 op)

The student will learn to control the industrial processes and environmental engineering objects by methods of automation technology.

A431122: Module Preparing for the Option, Module 2, 20,5 - 21,5 op

Compulsory

031044A: Mathematical Methods, 4 op
 477603A: Control System Design, 4 op
 477033A: Programming in Matlab, 2,5 op
 477012P: Introduction to Automation Engineering, 5 op
 477601A: Process Automation Systems, 4 op
 477602A: Control System Analysis, 4 op

Supplementary Module (10 op)

The student will learn non-technical skills and e.g. social and multicultural skills required in engineering design, research, development and education.

902011P Technical English 3 * Instead of English, the student can choose another foreign language (more information in the Study Guide)

A431146: Supplementary Module/Bachelor's Degree, 10 op

E

- 030001P: Orientation Course for New Students, 1 op
- 030005P: Information Skills, 1 op
- 901008P: Second Official Language (Swedish), 2 op
- 900009P: Second Official Language (Finnish), 2 op

Alternative

- 902011P: Technical English 3, 6 op
- 903012P: Technical German 3, 6 op

Bachelor's Thesis and studies included (10 op)

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

Bachelor's degree of Environmental Engineering

Tutkintorakenteen tila: archived

Lukuvuosi: 2011-12

Lukuvuoden alkamispäivämäärä: 01.08.2011

Basic and Intermediate Studies (120.5 op)

The student will learn to apply phenomena-based desing and static and dynamic modelling in the context of process and environmental engineering, as well as to examine physical, chemical, biological and geoscientific phenomena.

A432120: Basic and Intermediate Studies, Environmental Engineering, 99,5 - 120,5 op

Compulsory

- 780109P: Basic Principles in Chemistry, 4 op
- 488302A: Basics of Biotechnology, 5 op
- 761103P: Electricity and Magnetism, 4 op
- 761101P: Basic Mechanics, 4 op
- 780122P: Introductory Laboratory Course in Chemistry, 3 op
- 780112P: Introduction to Organic Chemistry, 4 op
- 031010P: Calculus I, 5 op
- 031017P: Differential Equations, 4 op
- 031019P: Matrix Algebra, 3,5 op
- 031021P: Probability and Mathematical Statistics, 5 op
- 031022P: Numerical Analysis, 5 op
- 477302A: Heat Transfer, 3 op
- 477101A: Fluid and Particle Engineering I, 3 op
- 477102A: Bulk Solids Handling, 4 op
- 477201A: Material and Energy Balances, 5 op
- 477202A: Reactor Analysis, 4 op
- 477301A: Momentum Transfer, 3 op
- 477303A: Mass Transfer, 3 op
- 477304A: Separation Processes, 5 op
- 477501A: Process dynamics, 5 op
- 477011P: Introduction to Process and Environmental Engineering I, 5 op
- 477401A: Thermodynamic Equilibria, 5 op
- 488104A: Industrial and Communal Waste Management, 5 op
- 488102A: Hydrological Processes, 5 op
- 488201A: Environmental Ecology, 5 op
- 488011P: Introduction to Environmental Engineering, 5 op
- 488301A: Microbiology, 3 op
- 761121P: Laboratory Exercises in Physics 1, 3 op
- 488308A: Enzyme Technology, 2 op

Module Preparing for the Option, Module 1 (20 op)

The goal is to learn to perceive industrial production activities as a whole, taking also the technological, economic, juridical and occupational safety and health issues into account.

A432121: Module Preparing for the Option, Module 1, 20 - 40 op

Compulsory

- 555220P: Basic Course in Industrial Engineering and Management, 3 op
- 555221P: Introduction to Production, 2 op
- 488012A: Environmental Legislation, 5 op
- 477203A: Process Design, 5 op
- 555260P: Basic Course in Occupational Safety and Wellbeing at Work, 3 op
- 555280P: Basic Course of Project Management, 2 op

Module Preparing for the Option, Module 2 (19.5 op)

The student will learn to control the industrial environmental and processes engineering objects by methods of automation technology.

A432122: Module Preparing for the Option, Module 2, 19,5 - 20,5 op

Compulsory

- 031044A: Mathematical Methods, 4 op
- 488001A: Practical Training, 3 op
- 477033A: Programming in Matlab, 2,5 op
- 477601A: Process Automation Systems, 4 op
- 477032A: AutoCAD in Process and Environmental Engineering, 2 op
- 477012P: Introduction to Automation Engineering, 5 op

Supplementary Module (10 op)

The student will learn non-technical skills and e.g. social and multicultural skills required in engineering design, research, development and education.

902011P Technical English 3 * Instead of English, the student can choose another foreign language (more information in the Study Guide)

A432146: Supplementary Module/Bachelor's Degree, 10 op

E

- 030001P: Orientation Course for New Students, 1 op
- 030005P: Information Skills, 1 op
- 901008P: Second Official Language (Swedish), 2 op
- 900009P: Second Official Language (Finnish), 2 op

Alternative

- 902011P: Technical English 3, 6 op
- 903012P: Technical German 3, 6 op

Bachelor's Thesis and studies included (10 op)

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

Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

774301A: A Basic Course in Geochemistry, 6 op
 555360S: Administration, Organization and Education in Working Life, 5 op
 477310S: Advanced Catalytic Processes, 5 op
 477607S: Advanced Control and Systems Engineering, 5 op
 488305S: Advanced Course for Biotechnology, 5 op
 488124S: Advanced Course in Hydrology, 5 op
 555345S: Advanced Course in Product Development, 6 op
 555385S: Advanced Course in Quality Management, 5 op
 300002M: Advanced Information Skills, 1 op
 477002S: Advanced Practical Training, 3 op
 488002S: Advanced Practical Training, 3 op
 477206S: Advanced Process Design, 6 op
 477311S: Advanced Separation Processes, 5 op
 555324S: Advanced Supply Chain Management, 3 op
 488204S: Air Pollution Control Engineering, 5 op
 488306S: Applied Microbiology, 7 op
 477508S: Automation in Metallurgical Industry, 5 op
 477507S: Automation in Pulp and Paper Industry, 5 op
 488407S: BEE Foreign Excursion to the Barents Region, 2 op
 477701A: Basic Course in Geology, 4 op
 555261A: Basic Course in Occupational Psychology, 3 op
 555240A: Basic Course in Product Development, 3 op
 555281A: Basic Course of Quality Management, 5 op
 740148P: Biomolecules, 5 op
 488307S: Bioprocess Engineering, 7 op
 488304S: Bioreactor Technology, 6 op
 477208S: Biorefineries, 3 op
 782627S: Chemical Applications in Hazardous Waste Management and Environmental Technology, 4 op
 477204S: Chemical Engineering Thermodynamics, 5 op
 477209S: Chemical Process Simulation, 5 op
 477104S: Chemical Wood Processing, 3 op
 555366S: Chemical and Physical Hazards in Industrial Environments, 3 op
 555365S: Computer-Aided Methods in Ergonomics, 3 op
 555363S: Creativity at Work and in Product Development, 5 op
 464088S: Diagnosis of Machine Condition, 8 op
 477605S: Digital Control Theory, 4 op
 488103A: Environmental Impact Assessment, 4 - 8 op
 488405S: Environmental Issues in the Barents Region, 5 op
 488205S: Environmental Load of Process Industry, 4 op
 555364S: Ergonomics, 5 op
 477111S: Excursion to Pulp and Paper Research Institute, 1 op
 555367S: Exercises in Work Science, 6 op
 477041S: Experimental Design, 5 op
 477413S: Experimental Research in Extractive Metallurgy, 10 op
 477606S: Fault Diagnosis and Process Performance Analysis, 2 op
 477705S: Field Course in Economic Geology, 2 op
 477305S: Flow Dynamics, 5 op
 477604S: Fundamentals of PID Control, 3 op
 477505S: Fuzzy-neuromethods in Process Automation, 4 op
 790101P: GIS-basics and Cartography, 5 op
 488115S: Geomechanics, 5 op
 477706S: Geophysical Investigation Methods of Bedrock, 3 op
 488404A: Global Change, 5 op
 488108S: Groundwater Engineering, 5 op
 555325S: Human Resources Management, 3 op

488203S: Industrial Ecology, 5 op
477207S: Industrial Water and Wastewater Technologies, 5 op
488406A: Introduction to Environmental Science, 5 op
783638S: Introduction to Fiber Chemistry of Polysaccharides, 3 op
465071A: Introduction to Materials Science, 3,5 op
771108P: Introduction to Ore Geology, 2 op
488113S: Introduction to Surface Water Quality Modelling, 5 op
488410A: Introduction to Sustainable Energy, 10 op
488401A: Introduction to the Environmental and Socio-economical Issues of the Barents Region, 2 op
477112S: Laboratory Exercise of Pulp and Paper Technology, 3 op
488118S: Laboratory Exercises and Field Measurements in Environmental Engineering, 10 op
464051A: Machine Drawing, 3,5 op
555361A: Machine Safety and Usability, 3,5 op
464087A: Maintenance Technology, 5 op
465061A: Materials Engineering I, 5 op
477105S: Mechanical Pulping, 3 op
740149P: Metabolism I, 4 op
740375A: Metabolism II, 4 op
477725S: Mine Automation, 7,5 op
477721S: Mineral Processing, 7,5 op
772619S: Mineralogical instrumental analytics, 4 op
477723S: Mining Economy and Risk Evaluation, 7,5 op
477707A: Mining Engineering, 5 op
477708S: Mining Project Feasibility Study, 4 op
477506S: Modelling and Control of Biotechnical Processes, 5 op
488111S: Modelling in Geoenvironmental Engineering, 5 op
740373A: Molecular Biology I, 4 op
477308S: Multicomponent Mass Transfer, 5 op
488121S: Municipality Geotechnics, 5 op
477306S: Non-ideal Reactors, 5 op
477724S: Numerical Mine Modelling, 5 op
488123S: Open Channel Flow and Hydraulic Structures, 5 op
488400A: Orientation to the BEE studies, 0 - 1 op
464074S: Paper Machinery Construction, 7 op
477107S: Paper Manufacture, 3 op
464085A: Patenting, 3,5 op
477412S: Phenomena-based modelling in extractive metallurgy, 10 op
465081S: Physical Metallurgy I, 7 op
465082S: Physical Metallurgy II, 7 op
477611S: Power Plant Automation, 2 op
477612S: Power Plant Control, 3 op
477704A: Principles of Mineral Processing, 5 op
477108S: Printing Technology, 3 op
477610S: Process Information Systems, 5 op
477504S: Process Optimization, 4 op
477414S: Process Simulation in Extractive Metallurgy, 10 op
477309S: Process and Environmental Catalysis, 5 op
465089S: Processing and Properties of Steels, 3,5 op
555322S: Production Management, 3 op
488202S: Production and Use of Energy, 5 op
555341S: Productivity and Performance Management, 3 op
555381S: Project Leadership, 5 op
555282A: Project Management, 4 op
555387S: Project Work in Quality Management, 5 op
555388S: Project Work in Project Management, 5 op
477109S: Pulp and Paper Laboratory Analyses, 3 op
477110S: Pulp and Paper Research Seminar, 3 op
555323S: Purchase Management, 3 op
555380S: Quality Management, 5 op
477106S: Recycled Fiber Processes, 3 op
477321S: Research Ethics, 3 op
477307S: Research Methodology, 5 op
555326S: Research Project in Production Management, 5 op
465075A: Research Techniques for Materials, 3,5 op

477113S: Research Training of Pulp and Paper Technology, 10 op
 555321S: Risk Management, 3 op
 477702A: Rock Engineering, 5 op
 555362S: Safety in Process Industry, 5 op
 477042S: Scientific Communication, 5 op
 773647S: Sedimentology, 6 op
 031050A: Signal Analysis, 4 op
 477503S: Simulation, 3 op
 488122S: Statistical Methods in Hydrology, 5 op
 555320S: Strategic Management, 5 op
 477703A: Surface Chemistry Principles of Minerals, 3 op
 488402A: Sustainable Development, 3 op
 772333A: Technical mineralogy, 5 op
 555340S: Technology Management, 4 op
 488117S: Water Resources Management, 5 - 7,5 op
 488105A: Water Supply Networks, 5 op
 488110S: Water and Wastewater Treatment, 5 op
 783619S: Wood Chemistry, 3 op

Opintojaksojen kuvaukset

Tutkintorakenteisiin kuuluvien opintokohteiden kuvaukset

A431120: Basic and Intermediate Studies, Process Engineering, 99,5 - 109,5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Basic and Intermediate Studies

Laji: Study module

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

780109P: Basic Principles in Chemistry, 4 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Chemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Minna Tiainen

Opintokohteen kielet: Finnish

Leikkaavuudet:

780120P	Basic Principles in Chemistry	5.0 op
ay780117P	General and Inorganic Chemistry A (OPEN UNI)	5.0 op
780115P	General and Inorganic Chemistry II	6.0 op
780114P	General and Inorganic Chemistry I	6.0 op
780113P	Introduction to Chemistry	12.0 op
780101P	Introduction to Physical Chemistry	7.0 op

780101P2	Physical Chemistry I	4.0 op
780107P	Basic Course in Inorganic and Physical Chemistry	7.5 op
780152P	Inorganic and Physical Chemistry I	7.5 op
780153P	General and Inorganic Chemistry	7.5 op
780154P	Basic Inorganic Chemistry	7.5 op

ECTS Credits:

4 credits

Language of instruction:

Finnish

Timing:

1st autumn

Learning outcomes:

Upon completion the student should be able to display an understanding of basic chemistry phenomenon; equilibrium of acids and bases, chemical equilibrium, redox reactions and stoichiometry.

Contents:

Introduction to chemistry, stoichiometry, redox reactions, chemical equilibrium, the equilibrium of acid and bases, buffer solutions, titration.

Learning activities and teaching methods:

36 hours of lectures

Target group:

Biology, Geology, Mechanical Engineering, Process Engineering, compulsory.
Geography, optional.

Recommended or required reading:

Petrucci, R.H., Harwood, W.S., and Herring, F.G.: General Chemistry: Principles and Modern Applications, Prentice Hall, 8th edition (2002) or a newer edition.

Assessment methods and criteria:

Final examination

Grading:

1-5/fail

Person responsible:

Lecturer Minna Tiainen

Other information:

This course is only for students who have chemistry as a minor subject.

This course has partly the same contents as the course Introduction to Chemistry (780113P) (and the course Introduction to Physical Chemistry). If a student performs also the course Introduction to Chemistry, this course will be cancelled in his/hers study register.

488011P: Introduction to Environmental Engineering, 5 op

Voimassaolo: 01.08.2005 - 31.12.2013

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Rauli Koskinen, Johanna Panula-Perälä, Jarmo Sallanko, Heikki Ojamo

Opintokohteen kielet: Finnish

Leikkaavuudet:

488010P Introduction to Process and Environmental Engineering II 5.0 op

480002A Basics of Environmental Technology 5.0 op

ECTS Credits:

5,0 credits

Language of instruction:

Finnish

Timing:

Implementation in 5th-6th periods.

Learning outcomes:

Objective: (Please note: the next description of the aims for this course applies to the lecture course taught in Finnish, not the book examination given in English). After performing this course, the student will have basic knowledge about hydrology, water protection and sanitary engineering, waste management, air protection, noise abatement, radiation protection and fundamentals of environmental biotechnology, and about the respective techniques. The student will have an understanding of the principles and necessity of environmental protection, and knowledge in the environmental detriments of different industries, traffic and communities, and their prevention methods.

Learning outcomes: (Please note: the next description of the learning outcomes for this course applies to the lecture course taught in Finnish, not the book examination given in English).

After completing this course by the lectures, the student will recognise and be able to verbally describe the basic features of hydrology, water protection and water and waste management. The student will also be able to define the most important factors associated to air protection, industrial ecology and noise abatement. He/she will also identify the different fields of environmental biotechnology and be able to list techniques related to those. Further, he/she can describe the environmental detriments caused by different industries, traffic and communities and well as the traditional and modern prevention methods of those. The student will be able to justify the necessity of environmental protection by using the terminology of technology.

Contents:

(Lecture course in Finnish). For foreigners, e.g. exchange students, the course is organised as a book examination in English. Books for the exam: Förstner U.1995. Integrated pollution control, pages 81-373; and Scragg A. 1999. Environmental Biotechnology. 0-582-27682-9, p. 1-21, 78-104 (or newer edition). Contact the teachers in advance to agree about the examination.

Learning activities and teaching methods:

Book exam for foreign students.

Recommended optional programme components:

Prerequisites are not required.

Recommended or required reading:

Books in the book exam.

Assessment methods and criteria:

Book examination for foreigners.

Person responsible:

Laboratory engineer Jarmo Sallanko, Assistant Rauli Koskinen, University teacher Johanna Panula-Perälä and professor Heikki Ojamo

Other information:

(Lecture course in Finnish). For foreigners, e.g. exchange students, the course is organised as a book examination in English. Books for the exam: Förstner U.1995. Integrated pollution control, pages 81-373; and Scragg A. 1999. Environmental Biotechnology. ISBN 0 582 27682 9, p. 1-21, 78-104 (or newer edition). Contact the teachers in advance to agree about the examination.

761103P: Electricity and Magnetism, 4 op

Opiskelumoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761119P	Electromagnetism 1	5.0 op
761119P-01	Electromagnetism 1, lectures and exam	0.0 op
761119P-02	Electromagnetism 1, lab. exercises	0.0 op
761113P-01	Electricity and magnetism, lectures and exam	0.0 op
761113P-02	Electricity and magnetism, lab. exercises	0.0 op
761113P	Electricity and magnetism	5.0 op
766319A	Electromagnetism	7.0 op

ECTS Credits:

4 credits

Language of instruction:

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

Timing:

Spring

Learning outcomes:

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

Contents:

Electromagnetic interaction is one of the four fundamental interactions in physics and many phenomena like light, radio waves, electric current, magnetism and formation of solid matter are based on electromagnetism. The current technological development is largely based on applications of electromagnetism in energy production and transfer, telecommunications and information technology. Contents in brief: Coulomb's law. Electric field and potential. Gauss's law. Capacitors and dielectrics. Electric current, resistors, electromotive force and DC circuits. Magnetic field, motion of a charged particle in electric and magnetic fields, and applications. Ampère's law and Biot-Savart law. Electromagnetic induction and Faraday's law. Inductance and inductors. R-L-C circuits, alternating current and AC circuits.

Learning activities and teaching methods:

Lectures 32 h, 6 exercises (12 h).

Target group:

Secondary subject students.

Recommended optional programme components:

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

Recommended or required reading:

Text book: H.D. Young and R.A. Freedman: University physics, Addison-Wesley, 12th edition, 2008, chapters 21-31. Also 11th and 10th editions can be used.

Lecture material: Finnish lecture material will be available on the web page of the course.

Assessment methods and criteria:

Four mini examinations and end examination or final examination.

Person responsible:

Anita Aikio

Other information:

<https://wiki oulu.fi/display/761103P/>

761101P: Basic Mechanics, 4 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761118P	Mechanics 1	5.0 op
761118P-01	Mechanics 1, lectures and exam	0.0 op
761118P-02	Mechanics 1, lab. exercises	0.0 op
761111P-01	Basic mechanics, lectures and exam	0.0 op
761111P-02	Basic mechanics, lab. exercises	0.0 op
761111P	Basic mechanics	5.0 op
761101P2	Basic Mechanics	4.0 op

ECTS Credits:

4 credits

Language of instruction:

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

Timing:

Autumn

Learning outcomes:

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

Contents:

We encounter many phenomena related to mechanics in our everyday life. Most engineering sciences are based on mechanics and mechanics forms the basis of many other fields of physics, also the modern physics.

Contents in brief: Short summary of vector calculus. Kinematics, projectile motion and circular motion. Newton's laws of motion. Work and different forms of energy. Momentum, impulse and collisions. Rotational motion and moment of inertia. Torque and angular momentum. Rigid body equilibrium problems. Gravitation. Periodic motion. Fluid mechanics.

Learning activities and teaching methods:

Lectures 32 h, 8 exercises (16 h).

Target group:

Secondary subject students.

Recommended optional programme components:

Knowledge of vector calculus and basics of differential and integral calculus would be desirable.

Recommended or required reading:

Text book: H.D. Young and R.A. Freedman: University physics, Addison-Wesley, 12th edition, 2008, chapters 1-14. Also 11th and 10th editions can be used.

Lecture material: Finnish lecture material will be available on the web page of the course.

Course material availability can be checked [here](#).

Assessment methods and criteria:

Four mini examinations and end examination or final examination.

Grading:

Scale 1-5 / fail

Person responsible:

Anita Aikio

Other information:

<https://wiki oulu.fi/display/761101P/>

780122P: Introductory Laboratory Course in Chemistry, 3 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Chemistry

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

3 credits

Language of instruction:

Finnish

Timing:

1st autumn or spring

Learning outcomes:

After this course the student can apply laboratory safety instructions and act accordingly to them. He/she can communicate by using basic laboratory terminology and can work in a group under guidance. The student identifies and can use basic laboratory tools. He/she can perform basic inorganic determinations : acid-base titrations, mass analysis or spectroscopic measurements and can apply them to analyze inorganic synthesis, study purity of products of organic synthesis by using thin layer chromatography and write a report related to the performance and analysis of the synthesis.

Contents:

Laboratory safety, bunsen burner, balances, volumetric measures, gravimetric determination, acid-base titration, pH, titration curves, acid-base indicators, buffer solutions, synthesis and analysis of Fe(II)oxalate, spectrophotometric determination, synthesis of acetyl salicylic acid, TLC.

Learning activities and teaching methods:

40 hours of laboratory work + demonstrations

Target group:

Biochemistry, Biology, Chemistry, Process Engineering, compulsory. Physical Sciences, Geology, Mathematical Sciences, optional.

Recommended optional programme components:

The course Basic Principles in Chemistry (780109P) passed or Biochemistry, Chemistry and teacher education students of Mathematics and Physics: simultaneous participation in the course Introduction to Chemistry (780113P).

Recommended or required reading:

Instruction Book (in Finnish): Kemian perustyöt

Assessment methods and criteria:

Final examination. Laboratory works and final examination has to be completed within next two terms.

Grading:

Pass/fail

Person responsible:

Prof. Marja Lajunen and teaching assistants.

780112P: Introduction to Organic Chemistry, 4 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Chemistry

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay780112P	Introduction to Organic Chemistry (OPEN UNI)	4.0 op
780103P	Introduction to Organic Chemistry	6.0 op
780103P2	Organic Chemistry I	6.0 op
780108P	Basic Course in Organic Chemistry	6.0 op

ECTS Credits:

4 credits

Language of instruction:

Finnish

Timing:

1 st autumn and 1 st spring

Learning outcomes:

Upon completion of the course, student should have acquired knowledge and understanding of fundamentals of organic chemistry: structures and properties of organic compounds, basic reactions and types of mechanisms.

Contents:

Basic reactions of organic compounds, basic principles of stereochemistry and reaction mechanisms: Additions, eliminations, substitutions, including aromatic electrophilic ones, reactions of carbonyl group. Applications.

Learning activities and teaching methods:

32 hours of lectures and applications

Target group:

Biology, Process Engineering, compulsory.

Physical Sciences, Geology, Geograhpy, Mathematical Sciences, optional.

Recommended optional programme components:

Upper secondary school chemistry.

Recommended or required reading:

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

Assessment methods and criteria:

Two intermediate examinations or one final examination

Grading:

1-5/fail

Person responsible:

Senior Assistant. Dr. J. Koskela

Other information:

Students attend the lectures of 780103 P Introduction of Organic Chemistry.

031010P: Calculus I, 5 op**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Mathematics Division**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Ilkka Lusikka**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

ay031010P Calculus I (OPEN UNI) 5.0 op

ECTS Credits:

5 cp

Language of instruction:

Finnish

Timing:

Period 1-3

Learning outcomes:

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

Contents:

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

Learning activities and teaching methods:

Term course. Lectures 5 h/week.

Recommended or required reading:

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

031017P: Differential Equations, 4 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Mathematics Division

Arvostelu: 1 - 5, pass, fail

Opettajat: Hamina, Martti Aulis

Opintokohteen kielet: Finnish

Leikkaavuudet:

800320A	Differential equations	5.0 op
031076P	Differential Equations	5.0 op

Language of instruction:

Finnish

Timing:

Period 4-6

Learning outcomes:

The students learn the concepts concerning differential equations and get the ability to read associated literature. The students will achieve adequate mathematical skills for treating differential equations. They can identify simple analytically solvable differential equations and they can solve these by using various methods.

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

Contents:

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

Learning activities and teaching methods:

Lectures 3h/week. Two intermediate exams or one final exam.

Recommended optional programme components:

Calculus I.

Recommended or required reading:

Lecture notes in Finnish. Kreyszig. E., Advanced Engineering Mathematics

031019P: Matrix Algebra, 3,5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Mathematics Division

Arvostelu: 1 - 5, pass, fail

Opettajat: Matti Peltola

Opintokohteen kielet: Finnish

Leikkaavuudet:

031078P Matrix Algebra 5.0 op

Language of instruction:

Finnish

Timing:

Period 1-3

Learning outcomes:

The course gives the elementary theory of linear equations, matrices and vector spaces. The eigenvalues and eigenvectors with applications are introduced.

Learning outcomes : After completing the course the student is able to apply arithmetic operations of matrices. He can solve system of linear equations by matrix methods and can apply iterative methods to find the solution of the system of linear equations. The student is able to recognise the vector space and can relate the concepts of linear transform and matrix. He can analyse matrices by the parameters, vectors and vector spaces of matrices. The student is able to diagonalize matrices and apply diagonalization to the simple applications.

Contents:

Vectors and matrices. Systems of linear equations. Vector spaces and linear transformations. The rank, nullity, row space and the column space of a matrix. The determinant of a matrix. Eigenvalues and eigenvectors of a matrix. The diagonalization with applications. The iterative methods of solving linear system of equations. The theorems of Gershgorin and Cayley- Hamilton.

Learning activities and teaching methods:

Term course. Lectures 4 h/week. Two examinations or final examination.

Recommended or required reading:

Grossman, S.I. : Elementary Linear Algebra.

031021P: Probability and Mathematical Statistics, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Mathematics Division

Arvostelu: 1 - 5, pass, fail

Opettajat: Jukka Kempainen

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay031021P Probability and Mathematical Statistics (OPEN UNI) 5.0 op

Language of instruction:

Finnish

Timing:

Period 4-6

Learning outcomes:

The course provides the student the fundamental knowledge of the basic concepts of probability, random variables, management of statistical material, hypothesis testing and estimation methods. Learning outcomes : After completing the course the student is able to use the basic concepts of probability and most important random variables and is also able to apply these to calculate probabilities and expected values. The student is also able to analyze statistical material by

calculating confidence intervals, formulating and testing hypotheses and by performing maximum likelihood estimations.

Contents:

Basic concepts of probability, conditional probability, discrete and continuous random variables and their distributions, expectation and variance, joint distributions, central limit theorem, elements of statistics, interval of confidence, hypothesis testing, maximum likelihood estimation.

Learning activities and teaching methods:

Term course. Lectures 4 h/week. Two examinations or a final examination.

Recommended optional programme components:

Calculus I and Calculus II.

Recommended or required reading:

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

031022P: Numerical Analysis, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Mathematics Division

Arvostelu: 1 - 5, pass, fail

Opettajat: Ruotsalainen Keijo

Opintokohteen kielet: Finnish

Language of instruction:

Finnish.

Timing:

Period 4-6

Learning outcomes:

The objective of the course is to provide the mathematical foundations of numerical methods, to analyze their basic theoretical properties (stability, accuracy and computational complexity), and demonstrate their performances on examples.

Learning outcomes : The student recognizes what numerical solution methods can be used to solve some specific mathematical problems, can perform the required steps in the numerical algorithm and is able to perform the error analysis.

Contents:

Numerical linearalgebra. Basics of the approximation theory. Numerical quadratures. Numerical methods for ordinary and partial differential equations.

Learning activities and teaching methods:

Lectures 4h/week. Two intermediate exams or one final exam.

Recommended or required reading:

•K. Ruotsalainen, Numeeriset menetelmät (lecture notes in finnish)

•Faires and Burden; Numerical methods

•A. Quarteroni, R. Sacco and F Salieri; Numerical mathematics

Prerequisites: Calculus 1, Calculus 2, Matrix algebra and Differential Equations.

477302A: Heat Transfer, 3 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tuomaala, Eero Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

477322A Heat and Mass Transfer 5.0 op

470620A Heat Transfer 3.0 op

Language of instruction:

Finnish

Timing:

Implementation in 5th period.

Learning outcomes:

Objective: To familiarise the student with the mechanism and models of heat transfer, applying them in practical problems, creating and solving differential energy balances, design of heat transfer networks and analysing working potential of heat flow.

Learning outcomes: After passing the course the student knows what happens when heat is transferred by conduction, convection and radiation. After the course 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. 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 is able to divide the costs of the used energy in right proportion based on the processing stage.

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.

Learning activities and teaching methods:

Lectures including exercises.

Recommended optional programme components:

Course 477301A Momentum Transfer is recommended beforehand.

Recommended or required reading:

Bird, R. B., Stewart, W.E. & Lightfoot, E.N., Transport Phenomena, John Wiley & Sons, 1976, 780 p.; Linnhoff, B. et al.: A User Guide on Process Integration for the Efficient Use of Energy, The Institution of Chemical Engineers, 1987, 247 p.

Additional literature: Jokilaakso, A., Virtaustekniikan, lämmönsiirron ja aineensiirron perusteet, 496, Otakustantamo, 1987, 194 p. Coulson, J.F. et al., Chemical engineering vol.1, 4th ed., Pergamon Press, 1990. 708 p. Peters, M.S. & Timmerhaus, K.D., Plant design and economics for chemical engineers, 4th ed., McGraw-Hill, 1991, 910 p. Sussman, M.V., Availability (exergy) analysis, Mulliken House, 1985, 94 p.

Assessment methods and criteria:

Examination or continuous evaluation.

Person responsible:

University teacher Eero Tuomaala

Other information:

477101A: Fluid and Particle Engineering I, 3 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Ämmälä, Niinimäki, Jouko Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

477121A Particle Technology 5.0 op
470101A Mechanical Process Engineering I 5.0 op

ECTS Credits:

3,0 credits

Language of instruction:

Finnish

Timing:

Implementation in 3rd period.

Learning outcomes:

Objective: To give basic knowledge about properties of particles, their analytics and mechanical processing of them.

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

Contents:

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

Learning activities and teaching methods:

Lectures and exercises.

Recommended optional programme components:

Introduction to Process Engineering 477011P

Recommended or required reading:

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

Assessment methods and criteria:

Exam. Literature exam possible for foreign students.

Person responsible:

Postdoctoral Research Fellow Ari Ämmälä

477102A: Bulk Solids Handling, 4 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Ämmälä

Opintokohteen kielet: Finnish

Leikkaavuudet:

477122A Bulk Solids Handling 5.0 op
470103A Mechanical Process Engineering III 5.0 op
470102A Mechanical Process Engineering II 5.0 op

ECTS Credits:

4,0 credits

Language of instruction:

Finnish

Timing:

Implementation in 4th period.

Learning outcomes:

Objective: To give basic knowledge about fluid mechanics, properties of granular materials and their transport, mixing and storage.

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

Contents:

Fluid mechanics, fluid transfer, mixing, properties affecting storage and transportation of granular material, storing of granular material, transportation of solid materials, mechanical conveyors, pneumatic and hydraulic transport, fluidization.

Learning activities and teaching methods:

Lectures and exercises.

Recommended optional programme components:

Fluid and Particle Engineering I 477102A

Recommended or required reading:

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

Assessment methods and criteria:

Exam. Literature exam possible for foreign students.

Person responsible:

Postdoctoral Research Fellow Ari Ämmälä

477201A: Material and Energy Balances, 5 op

Voimassaolo: 01.08.2005 - 31.12.2019

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477221A Material and Energy Balances 5.0 op

470220A Fundamentals of Chemical Process Engineering 5.0 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish.

Timing:

Periods 1-2.

Learning outcomes:

Objective: Creates the basis for examining processes based on material and energy balances.

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.

Learning activities and teaching methods:

Lectures and group exercises.

Recommended optional programme components:

Basics from the course Introduction to Process Engineering.

Recommended or required reading:

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

Assessment methods and criteria:

Continual assessment based on exams and group exercises.

Person responsible:

Kaisa Lamminpää

477202A: Reactor Analysis, 4 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ahola, Juha Lennart

Opintokohteen kielet: Finnish

Leikkaavuudet:

477222A Reactor Analysis 5.0 op

470221A Reactor Analysis and Design I 5.0 op

ECTS Credits:

4,0 cr

Language of instruction:

Finnish

Timing:

Period 3.

Learning outcomes:

Objective: The basic methods in Chemical Reaction Engineering.

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

Contents:

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

Learning activities and teaching methods:

Lectures and small group exercises.

Recommended optional programme components:

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

Recommended or required reading:

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

Assessment methods and criteria:

Combination of examination and group exercises.

Person responsible:

477301A: Momentum Transfer, 3 op**Voimassaolo:** 01.08.2005 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Process and Environmental Engineering**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Ainassaari, Kaisu Maritta, Tuomaala, Eero Juhani**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

477052A Fluid Mechanics 5.0 op

470619A Fluid Mechanics 3.0 op

ECTS Credits:

3,0 cr

Language of instruction:

Finnish

Timing:Implementation in 4th period.**Learning outcomes:**

Objective: Fluid flow, heat transfer and mass transfer are common phenomena in the process industry. Therefore, it is important for a process engineer to understand the fundamentals of these transport phenomena. Fundamentals of momentum transfer and associated models and practical applications are presented. Basic principles of computational fluid dynamics are presented.

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. Basic principles of computational fluid dynamics (CFD).

Learning activities and teaching methods:

Lectures including exercises.

Recommended optional programme components:

Knowledge of solving differential equations.

Recommended or required reading:

Bird, R.B., Stewart, W.E. & Lightfoot, E.N., Transport phenomena, John Wiley & Sons, 1976, 780 p.

Additional literature: Jokilaakso, A., Virtaustekniikan, lämmönsiirron ja aineensiirron perusteet, 496, Otakustantamo, 1987, 194 p. Coulson, J.F. et al., Chemical engineering vol.1, 4th ed., Pergamon Press, 1990. 708 p. Shaw, C.T., Using computational fluid dynamics, Prentice Hall, 1992, 251 p.

Assessment methods and criteria:

Examination or continuous evaluation.

Person responsible:

University teacher Eero Tuomaala

Other information:

477303A: Mass Transfer, 3 op**Voimassaolo:** 01.08.2005 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Process and Environmental Engineering**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Ainassaari, Kaisu Maritta, Tuomaala, Eero Juhani**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

477322A Heat and Mass Transfer 5.0 op

470621A Mass Transfer 3.0 op

ECTS Credits:

3,0 cr

Language of instruction:

Finnish

Timing:Implementation in 1st period.**Learning outcomes:****Objective:** To understand the physical and chemical phenomena in mass transfer. Creating mass transfer models and applying theory to analysis and scale-up of mass transfer processes.**Learning outcomes:** After the course the student is able to explain diffusion as a phenomenon and the factors affecting it. He/she is able to model mass transfer in simple systems by using the theories of Fick and Maxwell-Stefan and to compare the models to each other. The student is capable of modeling diffusion by differential mass balances. He/she recognises the special features of mass transfer in turbulent systems and the role of different transport phenomena in mass transfer equipment. He/she has rudimentary practical skills applicable to the scale-up of the equipment used for absorption.**Contents:**

Diffusion. The laws of diffusion by Fick and Maxwell-Stefan. Mass transfer in simple systems. Differential mass balances. Models of mass transfer in turbulent systems. Interphase mass transfer. Absorption. Drying of solid.

Learning activities and teaching methods:

Lectures including exercises.

Recommended optional programme components:

Courses 477301A Momentum Transfer and 477302A Heat Transfer are recommended beforehand.

Recommended or required reading:

Bird, R.B., Stewart, W.E. & Lightfoot, E.N.: Transport Phenomena, John Wiley & Sons, 1976, 780 p.; King, C.J.: Separation Processes, McGraw-Hill, 1980, 850 p.; Wesselingh J.A. & Krishna R.: Mass Transfer, Ellis Horwood, 1990, 243 p.

Additional literature: Jokilaakso, A., Virtaustekniikan, lämmönsiirron ja aineensiirron perusteet, 496, Otakustantamo, 1987, 194 p.; Coulson, J.F. et. al.: Chemical Engineering vol.1, 4th ed., Pergamon Press, 1990. 708 p.; McCabe, W.L. et al.: Unit Operations of Chemical Engineering, 5th ed., McGraw-Hill, 1993, 1130 p.**Assessment methods and criteria:**

Examination or continuous evaluation.

Person responsible:

University teacher Kaisu Ainassaari

Other information:**477304A: Separation Processes, 5 op**

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

470323A Separation Processes 5.0 op

ECTS Credits:

5 cr

Language of instruction:

Finnish

Timing:

Implementation in periods 1-2.

Learning outcomes:

Objective: Separation processes are usually the most common and also expensive part in industrial processes. Separation processes based on mass transfer theory are studied: the operational principle, factors affecting the operation, principles of design, and real equipment.

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.

Learning activities and teaching methods:

Lectures including exercises.

Recommended optional programme components:

Courses 477301A Momentum Transfer, 477302A Heat Transfer and 477303A Mass Transfer are recommended beforehand.

Recommended or required reading:

King, C.J.: Separation Processes, McGraw-Hill, 1980, 850 p.; Noble, R.D. & Terry, P.A.: Principles of Chemical Separations with Environmental Applications. Cambridge 2004, Cambridge University Press, 321 p.

Additional literature: Henley, E.S. & Seader, J.D.: Equilibrium Stage Separation Operations in Chemical Engineering, John Wiley & Sons, 1981, 742 p.; McCabe, W.L. et al.: Unit Operations of Chemical Engineering, 5th ed., McGraw-Hill, 1993, 1130 p.; Rousseau, R.W.: Handbook of Separation Process Technology, John Wiley & Sons, 1987, 1010 p.

Assessment methods and criteria:

Homework assignments affect the course grade. Examination.

Person responsible:

Professor Riitta Keiski

477501A: Process dynamics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay477501A Process Control Engineering I 5.0 op

470431A Process Control Engineering I 5.0 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 3rd period.

Learning outcomes:

To provide understanding of analytical process modelling, dynamics of industrial processes and industrial control principles. 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 larger processes.

Learning activities and teaching methods:

Lectures and exercises. Home work and two mid-tests. Possibility to take a book test and home exercises form the book by Luyben (see below).

Recommended optional programme components:

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

Recommended or required reading:

Lecture handout in the web. Additional literature : Luyben, W.L.: Process Modeling, Simulation and Control for Chemical Engineers. McGraw Kogakusha Ltd., Tokyo 1973, 558 pp.; Yang, W.J., Masubuchi, M.: Dynamic Process and System Control. Gordon and Breach Science Publishers, New York 1970, 448 pp.

Person responsible:

Professor Kauko Leiviskä

477502A: Process Control Engineering II, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: Finnish

Leikkaavuudet:

470432A Process Control Engineering II 5.0 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 6th period.

Learning outcomes:

To provide understanding of experimental process modelling, design of process experiments and analysis and use of experimental data. Learning outcomes: After the course, the student knows different experimental design methods and their applicability for different problems. He can also design experiments for multivariable 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.

Learning activities and teaching methods:

Lectures and extensive exercise work. Examination. Possibility to take the course also according to the principle of continuous evaluation.

Recommended optional programme components:

Course Process Control Engineering I recommended beforehand.

Recommended or required reading:

Lecture handout in the web.

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

Person responsible:

Professor Kauko Leiviskä

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

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Fabritius, Timo Matti Juhani, Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

Leikkaavuudet:

470219A Introduction to Process Engineering 3.5 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 1st-3rd periods.

Learning outcomes:

Objective: To give an overview on process and environmental engineering and to get familiar with the concepts of these disciplines.

Learning outcomes: Students can examine industrial processes using the methods and perspectives of process and environmental engineering (e.g. unit operations, mass and energy balances, identification of mechanical, chemical and transport phenomena in the processes, automation, process design) and they recognize the role of different areas of the process and environmental engineering, when these areas are considered in the forthcoming courses.

Contents:

1. Introduction to process engineering. 2. Mechanical unit operations. 3. Transport phenomena. 4. Reaction engineering. 5. Structures. 6. Automation. 7. Bioprocess engineering and its possibilities. 8. Process design.

Learning activities and teaching methods:

Group exercises and contact-education that supports these exercises. Only in Finnish.

Recommended optional programme components:

No prerequisites.

Recommended or required reading:

Material will be distributed during lectures and exercises.

Assessment methods and criteria:

Group-exercises. Please note that the course is not organised for the English speaking students.

Person responsible:

Professor Timo Fabritius

477021A: Laboratory Exercises of Process Engineering, 4 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

480320A	Laboratory Exercises of Process Engineering	3.5 op
470223A	Laboratory Experiments of Chemical Process Engineering	3.5 op
470325A	Laboratory Exercises of Mass and Heattransfer	3.0 op
470440A	Laboratory Exercises in Systems Engineering	2.5 op
470442A	Process Control Engineering Laboratory Exercises	3.0 op

ECTS Credits:

4 cr

Language of instruction:

Finnish

Timing:

Periods 1-6

Learning outcomes:

Objective:The student will familiarize with occupational practice of the field and experimental research and also learn how to report results.

Learning outcomes:The student knows how to calculate the overall heat-transfer coefficient for co- and countercurrent heat exchangers with the aid of temperatures and flows. The student identifies the main mechanical unit processes and is able to explain their operation principle. Student knows how to implement tools to estimate reaction kinetic parameters based on experimental batch reactor data. The student is familiar with the stages of reactor design in early phases of process design. The student demonstrates in the laboratory exercises that he/she can use a programmable logic and is able to tune the PID controller experimental facilities.

Contents:

The student chooses four laboratory exercises from the offered ones related to process and automation engineering.

Learning activities and teaching methods:

Laboratory work and the report.

Recommended or required reading:

Will be announced later.

Assessment methods and criteria:

Laboratory work and the report.

Person responsible:

University teachers

477401A: Thermodynamic Equilibria, 5 op**Voimassaolo:** 01.08.2005 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Process and Environmental Engineering**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Eetu-Pekka Heikkinen**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

470611A Metallurgy Processes 7.0 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 2nd period.

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

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

Learning activities and teaching methods:

Lectures, software exercise as well as other exercises. Only in Finnish.

Recommended optional programme components:

'Kemian perusteet' and 'Material and Energy Balances' as prerequisites.

Recommended or required reading:

Material will be distributed during lectures and exercises.

Assessment methods and criteria:

Students are required to make a portfolio consisting of a learning diary and exercises. Please note that the course is not organised for the English speaking students.

Person responsible:

University teacher Eetu-Pekka Heikkinen

477402A: Structure of Solid Materials, 5 op**Voimassaolo:** 01.08.2005 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Process and Environmental Engineering**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Pekka Tanskanen**Opintokohteen kielet:** Finnish

Leikkaavuudet:

470611A Metallurgy Processes 7.0 op

ECTS Credits:

5 cr

Language of instruction:

Finnish

Timing:

Implementation in 6th period.

Learning outcomes:

Objective: This course aims to increase the ability of students to understand structure and properties of solid inorganic materials and interdependency between the structure and properties. Additionally, characterization methods of solid materials and the importance solid mineral materials for modern society and their sources, usage, refining chains and environmental impacts are introduced.

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

Contents:

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

Learning activities and teaching methods:

Lectures. Only in Finnish.

Recommended or required reading:

Material will be distributed during lectures.

Assessment methods and criteria:

Written exam. Please note that the course is not organized for the English speaking students.

Person responsible:

University teacher Pekka Tanskanen.

761121P: Laboratory Exercises in Physics 1, 3 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761115P Laboratory Exercises in Physics 1 5.0 op
 761118P-01 Mechanics 1, lectures and exam 0.0 op
 761115P-02 Laboratory Exercises in Physics 1, laboratory exercises 0.0 op
 761115P-01 Laboratory Exercises in Physics 1, lecture and exam 0.0 op
 761114P-01 Wave motion and optics, lectures and exam 0.0 op
 761113P-01 Electricity and magnetism, lectures and exam 0.0 op

ECTS Credits:

3 credits

Language of instruction:

The lectures and the instruction material will be in Finnish. The laboratory experiments will be made in groups guided either in Finnish or in English.

Timing:

Autumn, spring.

Learning outcomes:

The student can safely make physical measurements, use different measurement tools, read different scales, handle the data, calculate the error estimations and make a sensible report of his laboratory measurements.

Contents:

The skill to make laboratory measurements is important for physicists. This is an introductory course how to make physical measurements and how to treat the measured data. Laboratory works are made in groups. The laboratory security is an essential part also in physics. Measurements are made with different instruments. As a result the most probable value is determined as well as its errors. The skills obtained during this course can be applied in the other laboratory courses Laboratory exercises in physics 2 and 3.

Learning activities and teaching methods:

Lectures 12 h, exercises 20 h (5 x 4 h).

Five different works will be made during the course in groups of up to 8 students.

Target group:

Compulsory in physics.

Recommended or required reading:

A booklet: Fysiikan laboratoriotyöt I, laboratoriotöiden työohje. Course material is in Finnish. A few English material is available in teaching laboratory.

Assessment methods and criteria:

Written reports of the experiments and a written examination.

Grading:

Scale 1-5 / fail

Person responsible:

Kari Kaila

Other information:

<https://wiki oulu.fi/display/761121P/>

Registration for the course and exams will be found by using the code 761121P-01

A431121: Module Preparing for the Option, Module 1, 29 - 40 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Module Preparing for the Option

Laji: Study module

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

555220P: Basic Course in Industrial Engineering and Management, 3 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Auvinen, Aila Irmeli
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish

Learning outcomes:

Learning outcomes: Upon completion the student should be able to describe IEM as a science and a profession, describe basic concepts of microeconometria, calculate basic calculations of microeconometria

Learning activities and teaching methods:

Lectures and excercises

Recommended or required reading:

Uusi-Rauva, E., Haverila, M., Kouri, I. & Miettinen, A. 2005. Teollisuustalous. 5. p.

Assessment methods and criteria:

Examination

Grading:

1.-5. / Fail

477001A: Practical Training, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Saara Luhtaanmäki

Opintokohteen kielet: Finnish

Leikkaavuudet:

477004A Practical Training 5.0 op

470065A Industrial Training Period (practice) 7.0 op

ECTS Credits:

3 cr

Learning outcomes:

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

Learning outcomes: During the practical training the student is exposed to his/her working environment from the point of view of his/her studies and becomes acquainted with one of a possible future job. The student can identify the problems associated with the working environment and can propose improvements to them. The student will experience points of contact between working life and studies.

Contents:

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

Person responsible:

Student Advisor Saara Luhtaanmäki

555221P: Introduction to Production, 2 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Auvinen, Aila Irmeli

Opintokohteen kielet: Finnish

Leikkaavuudet:

555225P Basics of industrial engineering and management 5.0 op

Language of instruction:

Finnish

Learning outcomes:

Learning outcomes:

Upon completion the student should be able to:

- explain the basic concepts of the production and view the decisions related to production systems in different situations
- explain the stages of the investment process
- solve some calculations, make design tasks, and evaluate them
- to describe the economic and administrative instruments of environmental law related to a factory

Learning activities and teaching methods:

Lectures and exercises

Recommended optional programme components:

555220P Basic course in industrial engineering and management, 555280P Basic course of project management.

Recommended or required reading:

Krajewski, L. J., Ritzman L. P. & Malhotra M.K. 2007. Operations management: processes and value chains. 8. p. Upper Saddle River (NJ), Pearson Prentice Hall. Chapters: 1. Operations as a Competitive Weapon, 2. Operations Strategy, 4. Process Strategy, 5. Process Analysis, 7. Constraint Management, 8. Process Layout ja 11. Location sekä Supplement A: Decision Making.

Assessment methods and criteria:

Examination

555280P: Basic Course of Project Management, 2 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Jaakko Kujala

Opintokohteen kielet: Finnish

Leikkaavuudet:

555288A Project Management 5.0 op

555285A Project management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish

Learning outcomes:

The objective of the course is to familiarise the student with the basics and the basic methods of project management.

Learning outcomes: Upon completion the student can explain the essential concepts related to project management. He can present the main features of a project plan and can use different methods of partitioning a project. The student can also schedule a project and estimate its costs. The student can explain the terms related to Earned value method and can apply the method on simple tasks. Upon completion the student recognizes the essential tasks of project risk management.

Contents:

Defining project management, project planning, organising and scope management, schedule management, cost management, earned value calculation and project risk management.

Learning activities and teaching methods:

Lectures and exercise book. The final grade is derived from the course exam.

555262A: Usability and Safety in Product Development, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Väyrynen

Opintokohteen kielet: Finnish

Leikkaavuudet:

555264P Managing well-being and quality of working life 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish.

Learning outcomes:

The course focuses on the theory and practice of a product design process that promotes safe and usable products.

Learning outcomes: After the course the student is able to analyze the usability of artefacts and design products that have good characteristics in usability. Students are able to compare the usability of artefacts using different methods.

Contents:

Requirement specification, user research, usability research, creation and evaluation of alternatives and the main course the standards are discussed. Examples and special topics are mostly related to information and communication technology or process technology areas. The course emphasizes these factors, management options and the emphasis on the specific product, product development and design, and the role of usability and security goals.

Recommended or required reading:

S. Väyrynen, N. Nevala & M. Päivinen (2004), Ergonomia ja käytettävyys suunnittelussa 336p. Other literature reported at the beginning of the course.

477203A: Process Design, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

480310A Fundamentals of Process Design 5.0 op

ECTS Credits:

5,0 cr

Language of instruction:

English

Timing:

Periods 4-5.

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

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

Learning activities and teaching methods:

Lectures and design group exercises.

Recommended optional programme components:

Objectives of 477202A Reactor analysis, 477304A Separation processes and 477012 Introduction to Automation Engineering

Recommended or required reading:

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

Assessment methods and criteria:

Combination of examination and design group exercises.

Person responsible:

University Lecturer Juha Ahola

555260P: Basic Course in Occupational Safety and Wellbeing at Work, 3 op**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Department of Industrial Engineering and Management**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Henri Jounila, Seppo Väyrynen**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

555265P Occupational Safety and Health Management 5.0 op

ay555260P Basic Course in Occupational Safety and Wellbeing at Work (OPEN UNI) 3.0 op

Voidaan suorittaa useasti: Kyllä**Language of instruction:**

Finnish.

Learning outcomes:

The course gives a general view of the legislation, safety promotion, occupational health, ergonomics development, and organising principles in modern production systems and in other work environments. Learning outcomes: After the course the student is capable of explaining basic terms, obligations and opportunities of work environment. He is able to assess the importance of occupational safety, health and well-being at work. In addition, he is able to explain the significance of occupational safety in the improving of productivity and quality.

Contents:

Students will acquire knowledge and practical skills which they will be able to utilize and integrate on ordinary engineering practice. Work accidents and occupational diseases. Legislation of occupational health.

Recommended or required reading:

Työsuojelun perusteet. Työterveyslaitos 2009. Other literature reported at the beginning of the course.

555223A: Introduction to Production Control, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Auvinen, Aila Irmeli

Opintokohteen kielet: Finnish

Leikkaavuudet:

555226A Operations and supply chain management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish

Contents:

Upon completion the student should be able to:

- explain the basic concepts of production control
- describe the objectives of production control and make some calculations related to production control
- describe the flow of production management in different situations and explain the decisions at various levels
- explain some basic production management tools and methods and calculate some basic calculations and also assess their relation to the success of an enterprise.

Learning activities and teaching methods:

Lectures and exercises

Recommended optional programme components:

555220P Basic course in industrial engineering and management, 555221P Introduction to production

Recommended or required reading:

Krajewski, L. J., Ritzman L. P. & Malhotra M.K., 2007. Operations management : processes and value chains. 8. p. Upper Saddle River (NJ), Pearson Prentice Hall. Soveltuvien osien kappaleet: 1. Operations as a Competitive Weapon, 2. Operations Strategy, 4. Process Strategy, 5. Process Analysis, 6. Process Performance and Quality, 9. Lean Systems, 10. Supply Chain Strategy, 12. Inventory Management, 13. Forecasting, 14. Sales and Operations Planning, 15. Resource Planning, 17. Scheduling.

Assessment methods and criteria:

Examination

555263A: Technology, Society and Work, 2 op

Voimassaolo: 01.08.2006 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Kisko, Kari Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

Language of instruction:

Finnish.

Learning outcomes:

The course focuses on the social, scientific and cultural significance and effects of technology. That is considered to be one of the general goals of research in engineering.

Learning outcomes: After the course the student understands how technology, society and work together have an affect on the life of people.

Contents:

The viewpoints stem mainly from the concepts of technology assessment and the philosophy of technology; STS (Science Technology Society) includes aspects of e. g. globalisation, environmental management, responsibility of technology, ethics, history and philosophy.

Recommended or required reading:

Pienyrityksen työympäristö tuloksen tekijänä. Työsuojeluoppaita ja -ohjeita 5. Työsuojeluhallinto 2006. Other literature reported at the beginning of the course.

477103A: Pulp and Paper Technology, 3 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Niinimäki, Jouko Juhani, Ari Ämmälä

Opintokohteen kielet: English

Leikkaavuudet:

488052A Introduction to Bioproduct and Bioprocess engineering 5.0 op

470308S Pulp and Paper Technology 2.5 op

ECTS Credits:

3,0 credits

Language of instruction:

Finnish

Timing:

Implementation in 5th period.

Learning outcomes:

Objective: To give basic knowledge about pulp and paper manufacturing.

Learning outcomes: Upon completion of the course, a student should be able to explain the most important structural and chemical properties of wood and fibres from bases of papermaking. The student is able to indentify different pulps used in papermaking and can explain essentially different pulping processes. The student can identify different paper grades and can explain the main unit processes of paper manufacturing.

Contents:

Wood handling, mechanical pulping, chemimechanical pulping, recycled fiber pulping, and papermaking. Structure and properties of fiber and interaction with water, fiber suspension and mechanical unit operations related to it.

Learning activities and teaching methods:

Lectures.

Recommended or required reading:

Book series: Fapet Oy. Papermaking Science and Technology, 19 books; Smook, G. A.: Handbook for Pulp and Paper Technologists. Vancouver 1992, 419 s. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:

Exam. Literature exam possible for foreign students.

Person responsible:

Postdoctoral Research Fellow Ari Ämmälä

A431122: Module Preparing for the Option, Module 2, 20,5 - 21,5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Module Preparing for the Option

Laji: Study module

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

*Compulsory***031044A: Mathematical Methods, 4 op**

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Mathematics Division

Arvostelu: 1 - 5, pass, fail

Opettajat: Hamina, Martti Aulis

Opintokohteen kielet: Finnish

ECTS Credits:

3

Language of instruction:

Finnish

Timing:

Period 1-2

Learning outcomes:

After completing the course the student is able to calculate the Fourier series of periodic functions and form their representation in the frequency domain. The student is also able to calculate the Fourier transform of functions and Z-transforms of discrete sequences and their inverse transforms. He or she is able to calculate gradient of functions and divergence and curl of vector fields. The simplest partial differential equations can be solved by the Fourier technique after the course.

Contents:

Complex numbers, Fourier series, the Fourier transform, Z-transform, gradient, divergence, curl, partial differential equation.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 40 h/Exercises 20 h/Self-study 20 h.

Target group:

The 2nd year of process and environmental engineering students.

Prerequisites and co-requisites:

The recommended prerequisites are the courses 031010P Calculus I , 031019P Probability and Mathematical Statistics and 031017P Differential Equations.

Recommended optional programme components:

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Recommended or required reading:

Kreyszig, E: Advanced Engineering Mathematics

Grading:

1-5

Person responsible:

Jukka Kemppainen

Working life cooperation:

-

Other information:

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477603A: Control System Design, 4 op**Voimassaolo:** 01.08.2005 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Process and Environmental Engineering**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Ikonen, Mika Enso-Veitikka, Seppo Honkanen**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

477622A Control System Design 5.0 op

470461A Fundamentals of Control and Systems Engineering II 5.0 op

ECTS Credits:

4,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 4th-5th periods.

Learning outcomes:

To give the student knowledge about the mathematical and practical methods used in control system design.

Learning outcomes: After completing the course the students can apply mathematical and graphical methods to the dynamics of process characterisation and control design. The period of study completed, the student can form the on-off-controller, PID-, lead- and lag controllers for the process, and tune them to the accuracy requirements of the customer and evaluate the behaviour of closed-loopsystems with the root locus technique.

Contents:

Controllers. Root locus method. Compensators in control system design. State-space representation of systems. Modern control engineering.

Learning activities and teaching methods:

Lectures and exercises.

Recommended or required reading:

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

Assessment methods and criteria:

Examination.

Person responsible:

Professor Enso Ikonen, Lecturer Jukka Hiltunen

477033A: Programming in Matlab, 2,5 op

Voimassaolo: 01.01.2009 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Pentti Jaako

Opintokohteen kielet: Finnish

Leikkaavuudet:

488051A AutoCAD and Matlab in Process and Environmental Engineering 5.0 op

ECTS Credits:

4 cr

Language of instruction:

Finnish

Timing:

Implementation in 1st period.

Learning outcomes:

The student masters the principles of structural programming and can write Matlab-programs.

Contents:

Programming languages, structural programming, functions, algorithms, specific features of Matlab-programming.

Learning activities and teaching methods:

Guided programming exercises, continuous evaluation.

Recommended or required reading:

Matlab-textbooks. Other literature: Kernighan, B.W. & Ritchie, D.M. (1988) The C Programming Language. Prentice Hall: NY

Person responsible:

University Lecturer Juha Jaako

477012P: Introduction to Automation Engineering, 5 op

Voimassaolo: 01.08.2005 - 31.07.2013

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes, Aki Sorsa, Harri Aaltonen, Hiltunen, Jukka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

488010P Introduction to Process and Environmental Engineering II 5.0 op

470433A Introduction to Control Engineering 5.0 op

470304S Fundamentals of Process Automation 2.5 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 4th-5th periods.

Learning outcomes:

Objective: The student knows the essential concepts, principles and device solutions of industrial automation, understands and also knows how to produce documents used in automation technology.

Learning outcomes : After completing the course the students know how to use the automation technique concepts for action descriptions and identifying problems. The students can draw on the PI- and block diagrams, using professional automation terms. The students will be able to use block diagrams, and adjustment problems of characterisation and solution. In addition, the student can select the appropriate instrument and conduct measurements using the most common field instruments. Students can identify physical and programming automation systems, as well as their meaning and purpose in relation to an operator's tasks requiring accuracy.

Contents:

Controlling the phenomena with the help of process and automation technology; structure of industrial automation: operational and structural description; process control and operation; PI-charts, symbols, block diagrams and block diagram algebra; control circuits: principles and implementation; process measurements, sensors and measuring equipment; control elements and dimensioning (mostly valves and motors); placing, installation and connection of field devices, signals and cabling.

Recommended or required reading:

Lecture handout.

Person responsible:

Professor Kauko Leiviskä and Lecturer Jukka Hiltunen

477601A: Process Automation Systems, 4 op**Voimassaolo:** 01.08.2005 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Process and Environmental Engineering**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Harri Aaltonen, Hiltunen, Jukka Antero**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

477051A Automation Engineering 5.0 op

470445S Digital Process Automation 4.0 op

ECTS Credits:

3,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 1st period.

Learning outcomes:

To give the student knowledge about automation systems and configuration especially in process technology. The student will have the basic information to work on design assignments in the field of process automation systems. Learning outcomes : The period of study completed, the students know how to handle the application designer in automation design, implementation and commissioning projects. Students can configure the basic automation features of automation systems and program them with logic.

Contents:

Procurement and delivery of automation in a project, system configuration, telecommunication technology used in automation, field buses, examples from commercial systems and field bus products.

Learning activities and teaching methods:

Lectures. Configuration exercises. Industrial visit. Examination.

Recommended or required reading:

Lecture handout. Additional literature : Will be announced later.

Person responsible:

University teacher Harri Aaltonen

477602A: Control System Analysis, 4 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hiltunen, Jukka Antero, Seppo Honkanen

Opintokohteen kielet: Finnish

Leikkaavuudet:

477621A Control System Analysis 5.0 op

470460A Controls and Systems Engineering Fundamentals 5.0 op

ECTS Credits:

4,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 1st-2nd periods.

Learning outcomes:

Objective: To give the student knowledge about control system analysis with mathematical methods.

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

Contents:

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

Learning activities and teaching methods:

Lectures and exercises.

Recommended or required reading:

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

Assessment methods and criteria:

Examination.

Person responsible:

Lecturer Jukka Hiltunen and university teacher Seppo Honkanen

A431146: Supplementary Module/Bachelor's Degree, 10 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Supplementary Module / Bachelor's Degree

Laji: Study module

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

E

030001P: Orientation Course for New Students, 1 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Faculty of Technology

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477000P Planning of Studies and Career 1.0 op

ECTS Credits:

1 credit.

Language of instruction:

Finnish.

Timing:

1-3 period.

Learning outcomes:

Upon completion of the course, students will be familiar with the university and the structure of the degree programme. They will be able to gain the tools they need for their studies and the planning of them.

Learning outcome: After the course the student is able to recognize his/her own study environment and can make use of the student services of the university. The course provides with skills to draft individual study plan and gives information about different methods of studying. The student can describe some specific professional aspects in the field of architecture or engineering and he/she is also able to use the facilities of academic libraries.

Contents:

Introduction to studies. Overview of the services offered by the university, student organizations and the Finnish social system (f.eg. student financial aid, academic sports services, student health services). Introduction to the University and the Faculty and their administration, degrees and studies at the Faculty of Technology. Overview of the professional aspects in the fields of engineering and architecture and job prospects. Introduction to the methods of studying and to the skills in gaining the tools needed for planning of the studies. Overview of library services, Oula - library catalogue and Nelli - e-resources.

Learning activities and teaching methods:

1. Orientation day for all new students organized by the Faculty of Technology. 2. Orientation to the degree programmes organized by the departments. 3. Student tutoring during the autumn term. Groups are formed during the degree programme orientation. 4. Information on areas of specialization within the degree programmes (during the 2nd or 3rd year). 5. Orientation (2 hours) to the library and Oula - library catalogue and Nelli - e-resources at the Science and Technology Library Tellus. Participation in orientations 1, 2 and 5 and min. 5 student tutorials are required for completion of the course.

Grading:

Pass/fail.

Person responsible:

Chief academic officer of the faculty, study advisors of the departments, library.

030005P: Information Skills, 1 op**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Faculty of Technology**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Koivuniemi, Mirja-Liisa, Sassali, Jani Henrik**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

030004P Introduction to Information Retrieval 0.0 op

ECTS Credits:

1 credit.

Language of instruction:

Finnish/English

Timing:

2nd or 3rd year.

Learning outcomes:

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

Contents:

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

Learning activities and teaching methods:

The course involves training sessions (8h), web-based learning materials, exercises in the Optima learning environment and a final assignment on a topic of the student's own choice.

Recommended or required reading:

Web-based learning material from Toolbox of Reseach (<https://wiki oulu.fi/display/tor/1.1+Finding+scientific+information>)

Assessment methods and criteria:

Passing the course requires participation in the training sessions and successful completion of the course assignments.

Grading:

pass/fail

Person responsible:

Science and Technology Library Tellus, tellustieto (at) oulu.fi <http://www.kirjasto oulu.fi/index.php?id=738>

Other information:

<http://www.kirjasto oulu.fi/index.php?id=738>

901008P: Second Official Language (Swedish), 2 op**Voimassaolo:** 01.08.1995 -**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Language Centre**Opintokohteen kielet:** Swedish**Leikkaavuudet:**

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

Ei opintojaksokuvauksia.

900009P: Second Official Language (Finnish), 2 op**Voimassaolo:** 01.08.1995 -**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Language Centre**Opintokohteen kielet:** Finnish*Alternative***902011P: Technical English 3, 6 op****Voimassaolo:** 01.08.1995 -**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Language Centre**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** English**Proficiency level:**[CEFR B2 - C1](#)**Language of instruction:**

English

Target group:**Students of all Engineering Departments (902011P Tekniikan englanti 3)****Students of the Department of Architecture (902011P Tekniikan englanti 3)****Person responsible:**Each department in the Technical Faculty has its own [Language Centre contact teacher](#) for questions about English studies.**Other information:**[See the Language Centre Study Guide, English, TTK](#)**903012P: Technical German 3, 6 op****Voimassaolo:** 01.08.1995 -**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Language Centre**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** German

Ei opintojaksokuvauksia.

477990A: Bachelor's Thesis / Process Engineering, 8 op**Voimassaolo:** 01.08.2007 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Process and Environmental Engineering**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish

Leikkaavuudet:

488990A Bachelor's Thesis / Environmental Engineering 8.0 op

Ei opintojaksokuvauksia.

477994A: Maturity Test / Bachelor of Science in Process Engineering Technology, 0 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

900060A: Technical Communication, 2 op

Voimassaolo: 01.08.2005 - 31.07.2021

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Language Centre

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900060A Technical Communication (OPEN UNI) 2.0 op

470218P Written and Oral Communication 3.0 op

Ei opintojaksokuvauksia.

A432120: Basic and Intermediate Studies, Environmental Engineering, 99,5 - 120,5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Basic and Intermediate Studies

Laji: Study module

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

*Compulsory***780109P: Basic Principles in Chemistry, 4 op**

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Chemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Minna Tiainen

Opintokohteen kielet: Finnish

Leikkaavuudet:

780120P Basic Principles in Chemistry 5.0 op

ay780117P	General and Inorganic Chemistry A (OPEN UNI)	5.0 op
780115P	General and Inorganic Chemistry II	6.0 op
780114P	General and Inorganic Chemistry I	6.0 op
780113P	Introduction to Chemistry	12.0 op
780101P	Introduction to Physical Chemistry	7.0 op
780101P2	Physical Chemistry I	4.0 op
780107P	Basic Course in Inorganic and Physical Chemistry	7.5 op
780152P	Inorganic and Physical Chemistry I	7.5 op
780153P	General and Inorganic Chemistry	7.5 op
780154P	Basic Inorganic Chemistry	7.5 op

ECTS Credits:

4 credits

Language of instruction:

Finnish

Timing:

1st autumn

Learning outcomes:

Upon completion the student should be able to display an understanding of basic chemistry phenomenon; equilibrium of acids and bases, chemical equilibrium, redox reactions and stoichiometry.

Contents:

Introduction to chemistry, stoichiometry, redox reactions, chemical equilibrium, the equilibrium of acid and bases, buffer solutions, titration.

Learning activities and teaching methods:

36 hours of lectures

Target group:

Biology, Geology, Mechanical Engineering, Process Engineering, compulsory.
Geography, optional.

Recommended or required reading:

Petrucci, R.H., Harwood, W.S., and Herring, F.G.: General Chemistry: Principles and Modern Applications, Prentice Hall, 8th edition (2002) or a newer edition.

Assessment methods and criteria:

Final examination

Grading:

1-5/fail

Person responsible:

Lecturer Minna Tiainen

Other information:

This course is only for students who have chemistry as a minor subject.

This course has partly the same contents as the course Introduction to Chemistry (780113P) (and the course Introduction to Physical Chemistry). If a student performs also the course Introduction to Chemistry, this course will be cancelled in his/hers study register.

488302A: Basics of Biotechnology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Johanna Panula-Perälä, Heikki Ojamo

Opintokohteen kielet: English

Leikkaavuudet:

488052A Introduction to Bioproduct and Bioprocess engineering 5.0 op

480430A Bioprocesses I 5.0 op

ECTS Credits:

5,0 credits

Language of instruction:

English

Timing:

Implementation in 4th-5th periods.

Learning outcomes:

After performing the course, the student has basic understanding of the current concepts of biotechnology and its applications in the food, environmental and pharmaceutical industries.

Learning outcomes:

After completing this course, the student will be able to explain how the modern biotechnology can be applied in the food, pharma- and material industries, in the mining industry and environmental biotechnology, for example, in the production of alcoholic beverages, antibiotics and other drugs, in metal manufacturing, and in biological degradation. Further, the student will be able to define the basics of cell structure and functions.

Contents:

Structure and function of cells: structure, growth, biomolecules and general description of the metabolic procedures, industrial organisms, structure and function of proteins, enzymes (catalysis and function in the regulation of metabolism), structure and function of genes, basics of gene technology. Food biotechnology: Production of beer and alcoholic beverages; Biotechnology in dairy industry. Biotechnology in the mining and materials industries. Biorefineries. Environmental Biotechnology: Biodegradation; Pharmabiotechnology: Production of antibiotics etc. pharmaceuticals. Biotransformations. Plant cell culture technology and plant derived biotech compounds.

Learning activities and teaching methods:

30 h lectures, group work and seminar.

Recommended optional programme components:

Course 488301A Microbiology or respective knowledge

Recommended or required reading:

Will be announced at the lectures. Supplementary material: Aittomäki E ym.: BioProsessitekniikka. WSOY 2002. 951-26995-6; Salkinoja-Salonen M (toim.): Mikrobiologian perusteita. Helsingin yliopisto, 2002. 951-45-9502-5.

Assessment methods and criteria:

Lectures, lecture exams and/or final exam. Grade will be composed of lecture exams and/or final exam, group work and seminar.

Person responsible:

University teacher Johanna Panula-Perälä

761103P: Electricity and Magnetism, 4 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761119P Electromagnetism 1 5.0 op

761119P-01	Electromagnetism 1, lectures and exam	0.0 op
761119P-02	Electromagnetism 1, lab. exercises	0.0 op
761113P-01	Electricity and magnetism, lectures and exam	0.0 op
761113P-02	Electricity and magnetism, lab. exercises	0.0 op
761113P	Electricity and magnetism	5.0 op
766319A	Electromagnetism	7.0 op

ECTS Credits:

4 credits

Language of instruction:

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

Timing:

Spring

Learning outcomes:

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

Contents:

Electromagnetic interaction is one of the four fundamental interactions in physics and many phenomena like light, radio waves, electric current, magnetism and formation of solid matter are based on electromagnetism. The current technological development is largely based on applications of electromagnetism in energy production and transfer, telecommunications and information technology. Contents in brief: Coulomb's law. Electric field and potential. Gauss's law. Capacitors and dielectrics. Electric current, resistors, electromotive force and DC circuits. Magnetic field, motion of a charged particle in electric and magnetic fields, and applications. Ampère's law and Biot-Savart law. Electromagnetic induction and Faraday's law. Inductance and inductors. R-L-C circuits, alternating current and AC circuits.

Learning activities and teaching methods:

Lectures 32 h, 6 exercises (12 h).

Target group:

Secondary subject students.

Recommended optional programme components:

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

Recommended or required reading:

Text book: H.D. Young and R.A. Freedman: University physics, Addison-Wesley, 12th edition, 2008, chapters 21-31. Also 11th and 10th editions can be used.

Lecture material: Finnish lecture material will be available on the web page of the course.

Assessment methods and criteria:

Four mini examinations and end examination or final examination.

Person responsible:

Anita Aikio

Other information:

<https://wiki oulu.fi/display/761103P/>

761101P: Basic Mechanics, 4 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761118P Mechanics 1 5.0 op

761118P-01	Mechanics 1, lectures and exam	0.0 op
761118P-02	Mechanics 1, lab. exercises	0.0 op
761111P-01	Basic mechanics, lectures and exam	0.0 op
761111P-02	Basic mechanics, lab. exercises	0.0 op
761111P	Basic mechanics	5.0 op
761101P2	Basic Mechanics	4.0 op

ECTS Credits:

4 credits

Language of instruction:

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

Timing:

Autumn

Learning outcomes:

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

Contents:

We encounter many phenomena related to mechanics in our everyday life. Most engineering sciences are based on mechanics and mechanics forms the basis of many other fields of physics, also the modern physics.

Contents in brief: Short summary of vector calculus. Kinematics, projectile motion and circular motion. Newton's laws of motion. Work and different forms of energy. Momentum, impulse and collisions. Rotational motion and moment of inertia. Torque and angular momentum. Rigid body equilibrium problems. Gravitation. Periodic motion. Fluid mechanics.

Learning activities and teaching methods:

Lectures 32 h, 8 exercises (16 h).

Target group:

Secondary subject students.

Recommended optional programme components:

Knowledge of vector calculus and basics of differential and integral calculus would be desirable.

Recommended or required reading:

Text book: H.D. Young and R.A. Freedman: University physics, Addison-Wesley, 12th edition, 2008, chapters 1-14. Also 11th and 10th editions can be used.

Lecture material: Finnish lecture material will be available on the web page of the course.

Course material availability can be checked [here](#).

Assessment methods and criteria:

Four mini examinations and end examination or final examination.

Grading:

Scale 1-5 / fail

Person responsible:

Anita Aikio

Other information:

<https://wiki oulu.fi/display/761101P/>

780122P: Introductory Laboratory Course in Chemistry, 3 op

Opiskelumoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Chemistry

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

3 credits

Language of instruction:

Finnish

Timing:

1st autumn or spring

Learning outcomes:

After this course the student can apply laboratory safety instructions and act accordingly to them. He/she can communicate by using basic laboratory terminology and can work in a group under guidance. The student identifies and can use basic laboratory tools. He/she can perform basic inorganic determinations : acid-base titrations, mass analysis or spectroscopic measurements and can apply them to analyze inorganic synthesis, study purity of products of organic synthesis by using thin layer chromatography and write a report related to the performance and analysis of the synthesis.

Contents:

Laboratory safety, bunsen burner, balances, volumetric measures, gravimetric determination, acid-base titration, pH, titration curves, acid-base indicators, buffer solutions, synthesis and analysis of Fe(II)oxalate, spectrophotometric determination, synthesis of acetyl salicylic acid, TLC.

Learning activities and teaching methods:

40 hours of laboratory work + demonstrations

Target group:

Biochemistry, Biology, Chemistry, Process Engineering, compulsory. Physical Sciences, Geology, Mathematical Sciences, optional.

Recommended optional programme components:

The course Basic Principles in Chemistry (780109P) passed or Biochemistry, Chemistry and teacher education students of Mathematics and Physics: simultaneous participation in the course Introduction to Chemistry (780113P).

Recommended or required reading:

Instruction Book (in Finnish): Kemian perustyöt

Assessment methods and criteria:

Final examination. Laboratory works and final examination has to be completed within next two terms.

Grading:

Pass/fail

Person responsible:

Prof. Marja Lajunen and teaching assistants.

780112P: Introduction to Organic Chemistry, 4 op**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

ay780112P	Introduction to Organic Chemistry (OPEN UNI)	4.0 op
780103P	Introduction to Organic Chemistry	6.0 op
780103P2	Organic Chemistry I	6.0 op
780108P	Basic Course in Organic Chemistry	6.0 op

ECTS Credits:

4 credits

Language of instruction:

Finnish

Timing:

1 st autumn and 1 st spring

Learning outcomes:

Upon completion of the course, student should have acquired knowledge and understanding of fundamentals of organic chemistry: structures and properties of organic compounds, basic reactions and types of mechanisms.

Contents:

Basic reactions of organic compounds, basic principles of stereochemistry and reaction mechanisms: Additions, eliminations, substitutions, including aromatic electrophilic ones, reactions of carbonyl group. Applications.

Learning activities and teaching methods:

32 hours of lectures and applications

Target group:

Biology, Process Engineering, compulsory.

Physical Sciences, Geology, Geograhpy, Mathematical Sciences, optional.

Recommended optional programme components:

Upper secondary school chemistry.

Recommended or required reading:

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

Assessment methods and criteria:

Two intermediate examinations or one final examination

Grading:

1-5/fail

Person responsible:

Senior Assistant. Dr. J. Koskela

Other information:

Students attend the lectures of 780103 P Introduction of Organic Chemistry.

031010P: Calculus I, 5 op**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Mathematics Division**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Ilkka Lusikka**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

ay031010P Calculus I (OPEN UNI) 5.0 op

ECTS Credits:

5 cp

Language of instruction:

Finnish

Timing:

Period 1-3

Learning outcomes:

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

Contents:

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

Learning activities and teaching methods:

Term course. Lectures 5 h/week.

Recommended or required reading:

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

031017P: Differential Equations, 4 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Mathematics Division

Arvostelu: 1 - 5, pass, fail

Opettajat: Hamina, Martti Aulis

Opintokohteen kielet: Finnish

Leikkaavuudet:

800320A	Differential equations	5.0 op
031076P	Differential Equations	5.0 op

Language of instruction:

Finnish

Timing:

Period 4-6

Learning outcomes:

The students learn the concepts concerning differential equations and get the ability to read associated literature. The students will achieve adequate mathematical skills for treating differential equations. They can identify simple analytically solvable differential equations and they can solve these by using various methods.

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

Contents:

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

Learning activities and teaching methods:

Lectures 3h/week. Two intermediate exams or one final exam.

Recommended optional programme components:

Calculus I.

Recommended or required reading:

Lecture notes in Finnish. Kreyszig. E., Advanced Engineering Mathematics

031019P: Matrix Algebra, 3,5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Mathematics Division

Arvostelu: 1 - 5, pass, fail

Opettajat: Matti Peltola

Opintokohteen kielet: Finnish

Leikkaavuudet:

031078P Matrix Algebra 5.0 op

Language of instruction:

Finnish

Timing:

Period 1-3

Learning outcomes:

The course gives the elementary theory of linear equations, matrices and vector spaces. The eigenvalues and eigenvectors with applications are introduced.

Learning outcomes : After completing the course the student is able to apply arithmetic operations of matrices. He can solve system of linear equations by matrix methods and can apply iterative methods to find the solution of the system of linear equations. The student is able to recognise the vector space and can relate the concepts of linear transform and matrix. He can analyse matrices by the parameters, vectors and vector spaces of matrices. The student is able to diagonalize matrices and apply diagonalization to the simple applications.

Contents:

Vectors and matrices. Systems of linear equations. Vector spaces and linear transformations. The rank, nullity, row space and the column space of a matrix. The determinant of a matrix. Eigenvalues and eigenvectors of a matrix. The diagonalization with applications. The iterative methods of solving linear system of equations. The theorems of Gershgorin and Cayley- Hamilton.

Learning activities and teaching methods:

Term course. Lectures 4 h/week. Two examinations or final examination.

Recommended or required reading:

Grossman, S.I. : Elementary Linear Algebra.

031021P: Probability and Mathematical Statistics, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Mathematics Division

Arvostelu: 1 - 5, pass, fail

Opettajat: Jukka Kemppainen

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay031021P Probability and Mathematical Statistics (OPEN UNI) 5.0 op

Language of instruction:

Finnish

Timing:

Period 4-6

Learning outcomes:

The course provides the student the fundamental knowledge of the basic concepts of probability, random variables, management of statistical material, hypothesis testing and estimation methods.

Learning outcomes : After completing the course the student is able to use the basic concepts of probability and most important random variables and is also able to apply these to calculate probabilities and expected values. The student is also able to analyze statistical material by calculating confidence intervals, formulating and testing hypotheses and by performing maximum likelihood estimations.

Contents:

Basic concepts of probability, conditional probability, discrete and continuous random variables and their distributions, expectation and variance, joint distributions, central limit theorem, elements of statistics, interval of confidence, hypothesis testing, maximum likelihood estimation.

Learning activities and teaching methods:

Term course. Lectures 4 h/week. Two examinations or a final examination.

Recommended optional programme components:

Calculus I and Calculus II.

Recommended or required reading:

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

031022P: Numerical Analysis, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Mathematics Division

Arvostelu: 1 - 5, pass, fail

Opettajat: Ruotsalainen Keijo

Opintokohteen kielet: Finnish

Language of instruction:

Finnish.

Timing:

Period 4-6

Learning outcomes:

The objective of the course is to provide the mathematical foundations of numerical methods, to analyze their basic theoretical properties (stability, accuracy and computational complexity), and demonstrate their performances on examples.

Learning outcomes : The student recognizes what numerical solution methods can be used to solve some specific mathematical problems, can perform the required steps in the numerical algorithm and is able to perform the error analysis.

Contents:

Numerical linear algebra. Basics of the approximation theory. Numerical quadratures. Numerical methods for ordinary and partial differential equations.

Learning activities and teaching methods:

Lectures 4h/week. Two intermediate exams or one final exam.

Recommended or required reading:

- K. Ruotsalainen, Numeeriset menetelmät (lecture notes in Finnish)
 - Faires and Burden; Numerical methods
 - A. Quarteroni, R. Sacco and F. Saleri; Numerical mathematics
- Prerequisites: Calculus 1, Calculus 2, Matrix algebra and Differential Equations.

477302A: Heat Transfer, 3 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tuomaala, Eero Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

477322A	Heat and Mass Transfer	5.0 op
470620A	Heat Transfer	3.0 op

Language of instruction:

Finnish

Timing:

Implementation in 5th period.

Learning outcomes:

Objective: To familiarise the student with the mechanism and models of heat transfer, applying them in practical problems, creating and solving differential energy balances, design of heat transfer networks and analysing working potential of heat flow.

Learning outcomes: After passing the course the student knows what happens when heat is transferred by conduction, convection and radiation. After the course 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. 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 is able to divide the costs of the used energy in right proportion based on the processing stage.

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.

Learning activities and teaching methods:

Lectures including exercises.

Recommended optional programme components:

Course 477301A Momentum Transfer is recommended beforehand.

Recommended or required reading:

Bird, R. B., Stewart, W.E. & Lightfoot, E.N., Transport Phenomena, John Wiley & Sons, 1976, 780 p.; Linnhoff, B. et al.: A User Guide on Process Integration for the Efficient Use of Energy, The Institution of Chemical Engineers, 1987, 247 p.

Additional literature: Jokilaakso, A., Virtaustekniikan, lämmönsiirron ja aineensiirron perusteet, 496, Otakustantamo, 1987, 194 p. Coulson, J.F. et al., Chemical engineering vol.1, 4th ed., Pergamon Press, 1990. 708 p. Peters, M.S. & Timmerhaus, K.D., Plant design and economics for chemical engineers, 4th ed., McGraw-Hill, 1991, 910 p. Sussman, M.V., Availability (exergy) analysis, Mulliken House, 1985, 94 p.

Assessment methods and criteria:

Examination or continuous evaluation.

Person responsible:

University teacher Eero Tuomaala

Other information:**477101A: Fluid and Particle Engineering I, 3 op**

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Ämmälä, Niinimäki, Jouko Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

477121A Particle Technology 5.0 op
 470101A Mechanical Process Engineering I 5.0 op

ECTS Credits:

3,0 credits

Language of instruction:

Finnish

Timing:

Implementation in 3rd period.

Learning outcomes:

Objective: To give basic knowledge about properties of particles, their analytics and mechanical processing of them.

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

Contents:

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

Learning activities and teaching methods:

Lectures and exercises.

Recommended optional programme components:

Introduction to Process Engineering 477011P

Recommended or required reading:

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

Assessment methods and criteria:

Exam. Literature exam possible for foreign students.

Person responsible:

Postdoctoral Research Fellow Ari Ämmälä

477102A: Bulk Solids Handling, 4 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Ämmälä

Opintokohteen kielet: Finnish

Leikkaavuudet:

477122A Bulk Solids Handling 5.0 op
 470103A Mechanical Process Engineering III 5.0 op
 470102A Mechanical Process Engineering II 5.0 op

ECTS Credits:

4,0 credits

Language of instruction:

Finnish

Timing:

Implementation in 4th period.

Learning outcomes:

Objective: To give basic knowledge about fluid mechanics, properties of granular materials and their transport, mixing and storage.

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

Contents:

Fluid mechanics, fluid transfer, mixing, properties affecting storage and transportation of granular material, storing of granular material, transportation of solid materials, mechanical conveyors, pneumatic and hydraulic transport, fluidization.

Learning activities and teaching methods:

Lectures and exercises.

Recommended optional programme components:

Fluid and Particle Engineering I 477102A

Recommended or required reading:

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

Assessment methods and criteria:

Exam. Literature exam possible for foreign students.

Person responsible:

Postdoctoral Research Fellow Ari Ämmälä

477201A: Material and Energy Balances, 5 op

Voimassaolo: 01.08.2005 - 31.12.2019

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

477221A Material and Energy Balances 5.0 op

470220A Fundamentals of Chemical Process Engineering 5.0 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish.

Timing:

Periods 1-2.

Learning outcomes:

Objective: Creates the basis for examining processes based on material and energy balances.

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.

Learning activities and teaching methods:

Lectures and group exercises.

Recommended optional programme components:

Basics from the course Introduction to Process Engineering.

Recommended or required reading:

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

Assessment methods and criteria:

Continual assessment based on exams and group exercises.

Person responsible:

Kaisa Lamminpää

477202A: Reactor Analysis, 4 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ahola, Juha Lennart

Opintokohteen kielet: Finnish

Leikkaavuudet:

477222A Reactor Analysis 5.0 op

470221A Reactor Analysis and Design I 5.0 op

ECTS Credits:

4,0 cr

Language of instruction:

Finnish

Timing:

Period 3.

Learning outcomes:

Objective: The basic methods in Chemical Reaction Engineering.

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

Contents:

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

Learning activities and teaching methods:

Lectures and small group exercises.

Recommended optional programme components:

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

Recommended or required reading:

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

Assessment methods and criteria:

Combination of examination and group exercises.

Person responsible:

University Lecturer Juha Ahola

477301A: Momentum Transfer, 3 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ainassaari, Kaisu Maritta, Tuomaala, Eero Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

477052A Fluid Mechanics 5.0 op

470619A Fluid Mechanics 3.0 op

ECTS Credits:

3,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 4th period.

Learning outcomes:

Objective: Fluid flow, heat transfer and mass transfer are common phenomena in the process industry. Therefore, it is important for a process engineer to understand the fundamentals of these transport phenomena. Fundamentals of momentum transfer and associated models and practical applications are presented. Basic principles of computational fluid dynamics are presented.

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. Basic principles of computational fluid dynamics (CFD).

Learning activities and teaching methods:

Lectures including exercises.

Recommended optional programme components:

Knowledge of solving differential equations.

Recommended or required reading:

Bird, R.B., Stewart, W.E. & Lightfoot, E.N., Transport phenomena, John Wiley & Sons, 1976, 780 p.

Additional literature: Jokilaakso, A., Virtaustekniikan, lämmönsiirron ja aineensiirron perusteet, 496,

Otakustantamo, 1987, 194 p. Coulson, J.F. et al., Chemical engineering vol.1, 4th ed., Pergamon Press,

1990. 708 p. Shaw, C.T., Using computational fluid dynamics, Prentice Hall, 1992, 251 p.

Assessment methods and criteria:

Examination or continuous evaluation.

Person responsible:

University teacher Eero Tuomaala

Other information:

477303A: Mass Transfer, 3 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ainassaari, Kaisu Maritta, Tuomaala, Eero Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

477322A Heat and Mass Transfer 5.0 op

470621A Mass Transfer 3.0 op

ECTS Credits:

3,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 1st period.

Learning outcomes:

Objective: To understand the physical and chemical phenomena in mass transfer. Creating mass transfer models and applying theory to analysis and scale-up of mass transfer processes.

Learning outcomes: After the course the student is able to explain diffusion as a phenomenon and the factors affecting it. He/she is able to model mass transfer in simple systems by using the theories of Fick and Maxwell-Stefan and to compare the models to each other. The student is capable of modeling diffusion by differential mass balances. He/she recognises the special features of mass transfer in turbulent systems and the role of different transport phenomena in mass transfer equipment. He/she has rudimentary practical skills applicable to the scale-up of the equipment used for absorption.

Contents:

Diffusion. The laws of diffusion by Fick and Maxwell-Stefan. Mass transfer in simple systems. Differential mass balances. Models of mass transfer in turbulent systems. Interphase mass transfer. Absorption. Drying of solid.

Learning activities and teaching methods:

Lectures including exercises.

Recommended optional programme components:

Courses 477301A Momentum Transfer and 477302A Heat Transfer are recommended beforehand.

Recommended or required reading:

Bird, R.B., Stewart, W.E. & Lightfoot, E.N.: Transport Phenomena, John Wiley & Sons, 1976, 780 p.; King, C.J.: Separation Processes, McGraw-Hill, 1980, 850 p.; Wesselingh J.A. & Krishna R.: Mass Transfer, Ellis Horwood, 1990, 243 p.

Additional literature: Jokilaakso, A., Virtaustekniikan, lämmönsiirron ja aineensiirron perusteet, 496, Otakustantamo, 1987, 194 p.; Coulson, J.F. et. al.: Chemical Engineering vol.1, 4th ed., Pergamon Press, 1990. 708 p.; McCabe, W.L. et al.: Unit Operations of Chemical Engineering, 5th ed., McGraw-Hill, 1993, 1130 p.

Assessment methods and criteria:

Examination or continuous evaluation.

Person responsible:

University teacher Kaisu Ainassaari

Other information:

477304A: Separation Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

470323A Separation Processes 5.0 op

ECTS Credits:

5 cr

Language of instruction:

Finnish

Timing:

Implementation in periods 1-2.

Learning outcomes:

Objective: Separation processes are usually the most common and also expensive part in industrial processes. Separation processes based on mass transfer theory are studied: the operational principle, factors affecting the operation, principles of design, and real equipment.

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.

Learning activities and teaching methods:

Lectures including exercises.

Recommended optional programme components:

Courses 477301A Momentum Transfer, 477302A Heat Transfer and 477303A Mass Transfer are recommended beforehand.

Recommended or required reading:

King, C.J.: Separation Processes, McGraw-Hill, 1980, 850 p.; Noble, R.D. & Terry, P.A.: Principles of Chemical Separations with Environmental Applications. Cambridge 2004, Cambridge University Press, 321 p.

Additional literature: Henley, E.S. & Seader, J.D.: Equilibrium Stage Separation Operations in Chemical Engineering, John Wiley & Sons, 1981, 742 p.; McCabe, W.L. et al.: Unit Operations of Chemical Engineering, 5th ed., McGraw-Hill, 1993, 1130 p.; Rousseau, R.W.: Handbook of Separation Process Technology, John Wiley & Sons, 1987, 1010 p.

Assessment methods and criteria:

Homework assignments affect the course grade. Examination.

Person responsible:

Professor Riitta Keiski

477501A: Process dynamics, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay477501A Process Control Engineering I 5.0 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 3rd period.

Learning outcomes:

To provide understanding of analytical process modelling, dynamics of industrial processes and industrial control principles. 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 larger processes.

Learning activities and teaching methods:

Lectures and exercises. Home work and two mid-tests. Possibility to take a book test and home exercises from the book by Luyben (see below).

Recommended optional programme components:

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

Recommended or required reading:

Lecture handout in the web. Additional literature : Luyben, W.L.: Process Modeling, Simulation and Control for Chemical Engineers. McGraw Kogakusha Ltd., Tokyo 1973, 558 pp.; Yang, W.J., Masubuchi, M.: Dynamic Process and System Control. Gordon and Breach Science Publishers, New York 1970, 448 pp.

Person responsible:

Professor Kauko Leiviskä

477011P: Introduction to Process and Environmental Engineering I, 5 op**Voimassaolo:** 01.08.2005 -**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Department of Process and Environmental Engineering**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Fabritius, Timo Matti Juhani, Eetu-Pekka Heikkinen**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

470219A Introduction to Process Engineering 3.5 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:Implementation in 1st-3rd periods.**Learning outcomes:**

Objective: To give an overview on process and environmental engineering and to get familiar with the concepts of these disciplines.

Learning outcomes: Students can examine industrial processes using the methods and perspectives of process and environmental engineering (e.g. unit operations, mass and energy balances, identification of mechanical, chemical and transport phenomena in the processes, automation, process design) and they recognize the role of different areas of the process and environmental engineering, when these areas are considered in the forthcoming courses.

Contents:

1. Introduction to process engineering. 2. Mechanical unit operations. 3. Transport phenomena. 4. Reaction engineering. 5. Structures. 6. Automation. 7. Bioprocess engineering and its possibilities. 8. Process design.

Learning activities and teaching methods:

Group exercises and contact-education that supports these exercises. Only in Finnish.

Recommended optional programme components:

No prerequisites.

Recommended or required reading:

Material will be distributed during lectures and exercises.

Assessment methods and criteria:

Group-exercises. Please note that the course is not organised for the English speaking students.

Person responsible:

Professor Timo Fabritius

477401A: Thermodynamic Equilibria, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

Leikkaavuudet:

470611A Metallurgy Processes 7.0 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 2nd period.

Learning outcomes:

Objective:The goal is to understand the fundamentals of thermodynamics in order to be able to consider thermodynamic equilibria in industrial processes.

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

Contents:

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

Learning activities and teaching methods:

Lectures, software exercise as well as other exercises. Only in Finnish.

Recommended optional programme components:

'Kemian perusteet' and 'Material and Energy Balances' as prerequisites.

Recommended or required reading:

Material will be distributed during lectures and exercises.

Assessment methods and criteria:

Students are required to make a portfolio consisting of a learning diary and exercises. Please note that the course is not organised for the English speaking students.

Person responsible:

University teacher Eetu-Pekka Heikkinen

488104A: Industrial and Communal Waste Management, 5 op

Voimassaolo: 01.08.2005 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Elisangela Heiderscheidt

Opintokohteen kielet: English

Leikkaavuudet:

480160S Waste Management of Communities and Industry 5.0 op

ECTS Credits:

5,0 cr

Language of instruction:

English

Timing:

Implementation in 5th-6th periods.

Learning outcomes:

To present the students with an overview of the waste produced by communities and industries, as well as to offer an introduction to waste management methods, technical principles and terminology and waste management legislation.

Contents:

Waste management hierarchy, waste sorting, logistics, waste prevention in industries, waste legislation, treatment of different industry waste, hazardous waste, municipal waste, biological waste treatment.

Learning activities and teaching methods:

The course is offered as a series of lectures given by specialists. It also includes field visits and waste-mapping assignment.

Recommended or required reading:

Lecture handout, notes and other materials delivered in lectures. Waste management: a reference handbook illustrated edition, 2008 (electronic book, ISBN 9781598841510).

Assessment methods and criteria:

Waste mapping report (grade 1-5) with 40% weight on the final grade; and an examination (graded 1-5) with 60% weight on the course final grade.

Person responsible:

N.N.

488102A: Hydrological Processes, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department 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:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 4th-5th periods.

Learning outcomes:

The student will be able to explain the main hydrological processes quantitatively through mathematical methods.

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, rivers and lakes.

Learning activities and teaching methods:

Lectures, calculus sessions and an assignment.

Recommended optional programme components:

Material and Energy Balances (recommended).

Recommended or required reading:

Lecture notes, solved exercises, RIL 141-1982 Yleinen vesitekniikka (Mustonen S, 1982, ISBN 951-758-024-X), RIL 124-1 Vesihuolto I (Karttunen E, 2003, ISBN 951-758-503-3), Sovellettu hydrologia (Mustonen S., 1986, ISBN 951-95555-1-X), Fluid Mechanics and Hydraulics (Giles RV, 1995, 3rd Edition, ISBN 0-07-020509-4). Physical Hydrology (Dingman SL, 2002, 2nd Edition, ISBN 978-1-57766-561-8), Maan vesi- ja ravinnetalous: Ojitus, kastelu ja ympäristö (Paasonen-Kivekäs M, Peltomaa R, Vakkilainen P, Äijö H, 2009, ISBN 978-952-5345-22-3)

Assessment methods and criteria:

Examination (1-5), the assignment (pass/fail).

Person responsible:

Professor Björn Klöve

Other information:

English version (self-study package) from the course is available.

488201A: Environmental Ecology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488210A Environmental science and technology 5.0 op

ay488201A Environmental Ecology (OPEN UNI) 5.0 op

480001A Environmental Ecology 5.0 op

Language of instruction:

In Finnish or English.

Learning outcomes:

The objective of the course is to provide a basic understanding of environmental ecology. Learning outcomes : The student is able to define the basic concepts of environmental ecology. He/she has knowledge about the state of the environment and is able to explain the essential environmental problems and the main effects of pollution. In addition, the student knows some solutions to environmental problems and is aware of ethical thinking in environmental engineering. The student also has basic knowledge about toxicology and epidemiology.

Contents:

Principles of environmental ecology. Roots of environmental problems. Global air pollution: ozone depletion, acid deposition, global warming and climate change. Water pollution, eutrophication, overexploitation of ground and surface water. Main effects of pollution and other stresses. Nonrenewable and renewable energy. Energy conservation and efficiency. Hazardous and solid waste problem. Principles of toxicology, epidemiology, and risk assessment. Environmental ethics.

Learning activities and teaching methods:

E-learning in the Optima learning environment.

Recommended or required reading:

Materials in the Optima environment.

488011P: Introduction to Environmental Engineering, 5 op

Voimassaolo: 01.08.2005 - 31.12.2013

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Rauli Koskinen, Johanna Panula-Perälä, Jarmo Sallanko, Heikki Ojamo

Opintokohteen kielet: Finnish

Leikkaavuudet:

488010P	Introduction to Process and Environmental Engineering II	5.0 op
480002A	Basics of Environmental Technology	5.0 op

ECTS Credits:

5,0 credits

Language of instruction:

Finnish

Timing:

Implementation in 5th-6th periods.

Learning outcomes:

Objective: (Please note: the next description of the aims for this course applies to the lecture course taught in Finnish, not the book examination given in English). After performing this course, the student will have basic knowledge about hydrology, water protection and sanitary engineering, waste management, air protection, noise abatement, radiation protection and fundamentals of environmental biotechnology, and about the respective techniques. The student will have an understanding of the principles and necessity of environmental protection, and knowledge in the environmental detriments of different industries, traffic and communities, and their prevention methods.

Learning outcomes: (Please note: the next description of the learning outcomes for this course applies to the lecture course taught in Finnish, not the book examination given in English).

After completing this course by the lectures, the student will recognise and be able to verbally describe the basic features of hydrology, water protection and water and waste management. The student will also be able to define the most important factors associated to air protection, industrial ecology and noise abatement. He/she will also identify the different fields of environmental biotechnology and be able to list techniques related to those. Further, he/she can describe the environmental detriments caused by different

industries, traffic and communities and well as the traditional and modern prevention methods of those. The student will be able to justify the necessity of environmental protection by using the terminology of technology.

Contents:

(Lecture course in Finnish). For foreigners, e.g. exchange students, the course is organised as a book examination in English. Books for the exam: Förstner U.1995. Integrated pollution control, pages 81-373; and Scragg A. 1999. Environmental Biotechnology. 0-582-27682-9, p. 1-21, 78-104 (or newer edition). Contact the teachers in advance to agree about the examination.

Learning activities and teaching methods:

Book exam for foreign students.

Recommended optional programme components:

Prerequisites are not required.

Recommended or required reading:

Books in the book exam.

Assessment methods and criteria:

Book examination for foreigners.

Person responsible:

Laboratory engineer Jarmo Sallanko, Assistant Rauli Koskinen, University teacher Johanna Panula-Perälä and professor Heikki Ojamo

Other information:

(Lecture course in Finnish). For foreigners, e.g. exchange students, the course is organised as a book examination in English. Books for the exam: Förstner U.1995. Integrated pollution control, pages 81-373; and Scragg A. 1999. Environmental Biotechnology. ISBN 0 582 27682 9, p. 1-21, 78-104 (or newer edition). Contact the teachers in advance to agree about the examination.

488301A: Microbiology, 3 op

Voimassaolo: 01.08.2005 - 31.07.2014

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Johanna Panula-Perälä

Opintokohteen kielet: Finnish

Leikkaavuudet:

488309A Biocatalysis 5.0 op

480010A General Microbiology 5.0 op

ECTS Credits:

5,0 credits.

Language of instruction:

Finnish

Timing:

In periods 1-3.

Learning outcomes:

The course provides the basics of microbiology to build a foundation for more advanced studies in microbiology, biotechnology and environmental engineering.

Learning outcomes: After completing this course, the student will be able to define a bacterium, a fungus, a virus and archaea, give examples of structurally different microbes, and list microbes by their energy metabolism and carbon sources. The student will be able to evaluate the cultivation, enrichment and prevention methods of microbes, and, under supervision, apply this knowledge at the laboratory practicals. The student will be able to explain the different microbial cycles of substances on Earth and, the waste

decontamination methods based on these cycles. He/she will be able to judge how microbes and enzymes could be applied in industry.

Contents:

The lectures give the basics of general and applied microbiology. The classification of microbes, especially bacteria, the structural and functional characteristics, and physiology and growth of prokaryotic cells; importance of microbes in different ecosystems, and applications of microbes in industry will be presented. The practical's include: Aseptic and sterile techniques, basic microbiological methods (inoculation, culturing on solid and liquid media, measurement of growth), observation and identification by using a microscope.

Learning activities and teaching methods:

24 h lectures + 30 h practical exercises

Recommended optional programme components:

Course "488011P Introduction to Environmental Engineering" or respective knowledge of microbiology and environmental biotechnology.

Recommended or required reading:

Lectures: Lecture hand out; Madigan MT, Martinko JM & Parker J: Brock Biology of Micro-organisms. Prentice Hall, 12th or newer edition. 0-13-049147-0; Salkinoja-Salonen M (toim.): Mikrobiologian perusteita. Helsingin yliopisto, 2002. 951-45-9502-5. Practicals: Course hand-out.

Assessment methods and criteria:

Lectures, lecture diary and exercises, practical exercises, laboratory note book, intermediate exams (välikokeet)/final examination and group work. Grade will be composed of lecture diary and exercises or intermediate exams (välikokeet)/final examination, practical exercises, laboratory note book and group work.

Person responsible:

University teacher Johanna Panula-Perälä

761121P: Laboratory Exercises in Physics 1, 3 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761115P	Laboratory Exercises in Physics 1	5.0 op
761118P-01	Mechanics 1, lectures and exam	0.0 op
761115P-02	Laboratory Exercises in Physics 1, laboratory exercises	0.0 op
761115P-01	Laboratory Exercises in Physics 1, lecture and exam	0.0 op
761114P-01	Wave motion and optics, lectures and exam	0.0 op
761113P-01	Electricity and magnetism, lectures and exam	0.0 op

ECTS Credits:

3 credits

Language of instruction:

The lectures and the instruction material will be in Finnish. The laboratory experiments will be made in groups guided either in Finnish or in English.

Timing:

Autumn, spring.

Learning outcomes:

The student can safely make physical measurements, use different measurement tools, read different scales, handle the data, calculate the error estimations and make a sensible report of his laboratory measurements.

Contents:

The skill to make laboratory measurements is important for physicists. This is an introductory course how to make physical measurements and how to treat the measured data. Laboratory works are made in groups. The laboratory security is an essential part also in physics. Measurements are made with different instruments. As a result the most probable value is determined as well as its errors. The skills obtained during this course can be applied in the other laboratory courses Laboratory exercises in physics 2 and 3.

Learning activities and teaching methods:

Lectures 12 h, exercises 20 h (5 x 4 h).

Five different works will be made during the course in groups of up to 8 students.

Target group:

Compulsory in physics.

Recommended or required reading:

A booklet: Fysiikan laboratoriotyöt I, laboratoriotöiden työohje. Course material is in Finnish. A few English material is available in teaching laboratory.

Assessment methods and criteria:

Written reports of the experiments and a written examination.

Grading:

Scale 1-5 / fail

Person responsible:

Kari Kaila

Other information:

<https://wiki oulu.fi/display/761121P/>

Registration for the course and exams will be found by using the code 761121P-01

488308A: Enzyme Technology, 2 op

Voimassaolo: 01.08.2012 - 31.07.2014

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

488309A Biocatalysis 5.0 op

Ei opintojaksokuvauksia.

A432121: Module Preparing for the Option, Module 1, 20 - 40 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Module Preparing for the Option

Laji: Study module

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

555220P: Basic Course in Industrial Engineering and Management, 3 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Auvinen, Aila Irmeli

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish

Learning outcomes:

Learning outcomes: Upon completion the student should be able to describe IEM as a science and a profession, describe basic concepts of microeconometria, calculate basic calculations of microeconometria

Learning activities and teaching methods:

Lectures and excercises

Recommended or required reading:

Uusi-Rauva, E., Haverila, M., Kouri, I. & Miettinen, A. 2005. Teollisuustalous. 5. p.

Assessment methods and criteria:

Examination

Grading:

1.-5. / Fail

555221P: Introduction to Production, 2 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Auvinen, Aila Irmeli

Opintokohteen kielet: Finnish

Leikkaavuudet:

555225P Basics of industrial engineering and management 5.0 op

Language of instruction:

Finnish

Learning outcomes:

Learning outcomes:

Upon completion the student should be able to:

- explain the basic concepts of the production and view the decisions related to production systems in different situations
- explain the stages of the investment process
- solve some calculations, make design tasks, and evaluate them
- to describe the economic and administrative instruments of environmental law related to a factory

Learning activities and teaching methods:

Lectures and exercises

Recommended optional programme components:

555220P Basic course in industrial engineering and management, 555280P Basic course of project management.

Recommended or required reading:

Krajewski, L. J., Ritzman L. P. & Malhotra M.K. 2007. Operations management: processes and value chains. 8. p. Upper Saddle River (NJ), Pearson Prentice Hall. Chapters: 1. Operations as a Competitive

Weapon, 2. Operations Strategy, 4. Process Strategy, 5. Process Analysis, 7. Constraint Management, 8. Process Layout ja 11. Location sekä Supplement A: Decision Making.

Assessment methods and criteria:

Examination

488012A: Environmental Legislation, 5 op

Voimassaolo: 01.01.2011 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eskelinen, Lauri Pertti Sakari, Iinatti, Heini Katariina

Opintokohteen kielet: English

Leikkaavuudet:

488101A Environmental Legislation 5.0 op

Ei opintojaksokuvauksia.

477203A: Process Design, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

480310A Fundamentals of Process Design 5.0 op

ECTS Credits:

5,0 cr

Language of instruction:

English

Timing:

Periods 4-5.

Learning outcomes:

Objective: Chemical process design principles

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

Contents:

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

Learning activities and teaching methods:

Lectures and design group exercises.

Recommended optional programme components:

Objectives of 477202A Reactor analysis, 477304A Separation processes and 477012 Introduction to Automation Engineering

Recommended or required reading:

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

Assessment methods and criteria:

Combination of examination and design group exercises.

Person responsible:

University Lecturer Juha Ahola

555260P: Basic Course in Occupational Safety and Wellbeing at Work, 3 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Henri Jounila, Seppo Väyrynen

Opintokohteen kielet: Finnish

Leikkaavuudet:

555265P Occupational Safety and Health Management 5.0 op

ay555260P Basic Course in Occupational Safety and Wellbeing at Work (OPEN UNI) 3.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish.

Learning outcomes:

The course gives a general view of the legislation, safety promotion, occupational health, ergonomics development, and organising principles in modern production systems and in other work environments. Learning outcomes: After the course the student is capable of explaining basic terms, obligations and opportunities of work environment. He is able to assess the importance of occupational safety, health and well-being at work. In addition, he is able to explain the significance of occupational safety in the improving of productivity and quality.

Contents:

Students will acquire knowledge and practical skills which they will be able to utilize and integrate on ordinary engineering practice. Work accidents and occupational diseases. Legislation of occupational health.

Recommended or required reading:

Työsuojelun perusteet. Työterveyslaitos 2009. Other literature reported at the beginning of the course.

555280P: Basic Course of Project Management, 2 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Jaakko Kujala

Opintokohteen kielet: Finnish

Leikkaavuudet:

555288A Project Management 5.0 op

555285A Project management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish

Learning outcomes:

The objective of the course is to familiarise the student with the basics and the basic methods of project management.

Learning outcomes: Upon completion the student can explain the essential concepts related to project management. He can present the main features of a project plan and can use different methods of partitioning a project. The student can also schedule a project and estimate its costs. The student can explain the terms related to Earned value method and can apply the method on simple tasks. Upon completion the student recognizes the essential tasks of project risk management.

Contents:

Defining project management, project planning, organising and scope management, schedule management, cost management, earned value calculation and project risk management.

Learning activities and teaching methods:

Lectures and exercise book. The final grade is derived from the course exam.

A432122: Module Preparing for the Option, Module 2, 19,5 - 20,5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Module Preparing for the Option

Laji: Study module

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory

031044A: Mathematical Methods, 4 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Mathematics Division

Arvostelu: 1 - 5, pass, fail

Opettajat: Hamina, Martti Aulis

Opintokohteen kielet: Finnish

ECTS Credits:

3

Language of instruction:

Finnish

Timing:

Period 1-2

Learning outcomes:

After completing the course the student is able to calculate the Fourier series of periodic functions and form their representation in the frequency domain. The student is also able to calculate the Fourier transform of functions and Z-transforms of discrete sequences and their inverse transforms. He or she is able to calculate gradient of functions and divergence and curl of vector fields. The simplest partial differential equations can be solved by the Fourier technique after the course.

Contents:

Complex numbers, Fourier series, the Fourier transform, Z-transform, gradient, divergence, curl, partial differential equation.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 40 h/Exercises 20 h/Self-study 20 h.

Target group:

The 2nd year of process and environmental engineering students.

Prerequisites and co-requisites:

The recommended prerequisites are the courses 031010P Calculus I , 031019P Probability and Mathematical Statistics and 031017P Differential Equations.

Recommended optional programme components:

-

Recommended or required reading:

Kreyszig, E: Advanced Engineering Mathematics

Grading:

1-5

Person responsible:

Jukka Kemppainen

Working life cooperation:

-

Other information:

-

488001A: Practical Training, 3 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Saara Luhtaanmäki

Opintokohteen kielet: Finnish

Leikkaavuudet:

477004A Practical Training 5.0 op

480099A Industrial Training Period (practice) 7.0 op

ECTS Credits:

3 cr

Learning outcomes:

To give an overview of the areas where the student will possibly work after graduation. Practical training nurtures theoretical study. In addition the training should give the student a general idea about the company and its technical and organizational operations, financial management and supervision. Training is usually offered in a position of an employee so that the student gets familiar with practical work and safety at work as well as with social nature in working environment. Students will land the jobs themselves. Learning outcomes: During the practical training the student is exposed to his/her working environment from the point of view of his/her studies and becomes acquainted with one of the possible jobs of the future. The student can name the problems associated with the working environment and can propose improvements. The student will experience points of contact between working life and the studies.

Contents:

Suitable areas for practical training are, for example, regional environment centers, environmental engineering and consulting offices, water-works, biotechnological and food industry, chemical industry, pulp and paper industry, metallurgical and mining industry, partly electronics and automation industry, and other areas in the private and public sectors.

Person responsible:

Student counselor Saara Luhtaanmäki

477033A: Programming in Matlab, 2,5 op

Voimassaolo: 01.01.2009 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Pentti Jaako

Opintokohteen kielet: Finnish

Leikkaavuudet:

488051A AutoCAD and Matlab in Process and Environmental Engineering 5.0 op

ECTS Credits:

4 cr

Language of instruction:

Finnish

Timing:

Implementation in 1st period.

Learning outcomes:

The student masters the principles of structural programming and can write Matlab-programs.

Contents:

Programming languages, structural programming, functions, algorithms, specific features of Matlab-programming.

Learning activities and teaching methods:

Guided programming exercises, continuous evaluation.

Recommended or required reading:

Matlab-textbooks. Other literature: Kernighan, B.W. & Ritchie, D.M. (1988) The C Programming Language. Prentice Hall: NY

Person responsible:

University Lecturer Juha Jaako

477601A: Process Automation Systems, 4 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Harri Aaltonen, Hiltunen, Jukka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

477051A Automation Engineering 5.0 op

470445S Digital Process Automation 4.0 op

ECTS Credits:

3,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 1st period.

Learning outcomes:

To give the student knowledge about automation systems and configuration especially in process technology. The student will have the basic information to work on design assignments in the field of process automation systems. Learning outcomes : The period of study completed, the students know how to handle the application designer in automation design, implementation and commissioning projects. Students can configure the basic automation features of automation systems and program them with logic.

Contents:

Procurement and delivery of automation in a project, system configuration, telecommunication technology used in automation, field buses, examples from commercial systems and field bus products.

Learning activities and teaching methods:

Lectures. Configuration exercises. Industrial visit. Examination.

Recommended or required reading:

Lecture handout. Additional literature : Will be announced later.

Person responsible:

University teacher Harri Aaltonen

477032A: AutoCAD in Process and Environmental Engineering, 2 op

Voimassaolo: 01.09.2008 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi, Virve Helena Kupiainen

Opintokohteen kielet: Finnish

Leikkaavuudet:

488051A AutoCAD and Matlab in Process and Environmental Engineering 5.0 op

ECTS Credits:

3,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 2nd-3rd periods.

Person responsible:

Researcher Pekka Rossi

477012P: Introduction to Automation Engineering, 5 op

Voimassaolo: 01.08.2005 - 31.07.2013

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes, Aki Sorsa, Harri Aaltonen, Hiltunen, Jukka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

488010P	Introduction to Process and Environmental Engineering II	5.0 op
470433A	Introduction to Control Engineering	5.0 op
470304S	Fundamentals of Process Automation	2.5 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 4th-5th periods.

Learning outcomes:

Objective: The student knows the essential concepts, principles and device solutions of industrial automation, understands and also knows how to produce documents used in automation technology.

Learning outcomes : After completing the course the students know how to use the automation technique concepts for action descriptions and identifying problems. The students can draw on the PI- and block diagrams, using professional automation terms. The students will be able to use block diagrams, and adjustment problems of characterisation and solution. In addition, the student can select the appropriate instrument and conduct measurements using the most common field instruments. Students can identify physical and programming automation systems, as well as their meaning and purpose in relation to an operator's tasks requiring accuracy.

Contents:

Controlling the phenomena with the help of process and automation technology; structure of industrial automation: operational and structural description; process control and operation; PI-charts, symbols, block diagrams and block diagram algebra; control circuits: principles and implementation; process measurements, sensors and measuring equipment; control elements and dimensioning (mostly valves and motors); placing, installation and connection of field devices, signals and cabling.

Recommended or required reading:

Lecture handout.

Person responsible:

Professor Kauko Leiviskä and Lecturer Jukka Hiltunen

A432146: Supplementary Module/Bachelor's Degree, 10 op**Voimassaolo:** 01.08.2005 -**Opiskelumuoto:** Supplementary Module / Bachelor's Degree**Laji:** Study module**Vastuuyksikkö:** Department of Process and Environmental Engineering**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

*E***030001P: Orientation Course for New Students, 1 op****Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Faculty of Technology**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

477000P Planning of Studies and Career 1.0 op

ECTS Credits:

1 credit.

Language of instruction:

Finnish.

Timing:

1-3 period.

Learning outcomes:

Upon completion of the course, students will be familiar with the university and the structure of the degree programme. They will be able to gain the tools they need for their studies and the planning of them. Learning outcome: After the course the student is able to recognize his/her own study environment and can make use of the student services of the university. The course provides with skills to draft individual study plan and gives information about different methods of studying. The student can describe some specific professional aspects in the field of architecture or engineering and he/she is also able to use the facilities of academic libraries.

Contents:

Introduction to studies. Overview of the services offered by the university, student organizations and the Finnish social system (f.eg. student financial aid, academic sports services, student health services). Introduction to the University and the Faculty and their administration, degrees and studies at the Faculty of Technology. Overview of the professional aspects in the fields of engineering and architecture and job prospects. Introduction to the methods of studying and to the skills in gaining the tools needed for planning of the studies. Overview of library services, Oula - library catalogue and Nelli - e-resources.

Learning activities and teaching methods:

1. Orientation day for all new students organized by the Faculty of Technology. 2. Orientation to the degree programmes organized by the departments. 3. Student tutoring during the autumn term. Groups are formed during the degree programme orientation. 4. Information on areas of specialization within the degree programmes (during the 2nd or 3rd year). 5. Orientation (2 hours) to the library and Oula - library catalogue and Nelli - e-resources at the Science and Technology Library Tellus. Participation in orientations 1, 2 and 5 and min. 5 student tutorials are required for completion of the course.

Grading:

Pass/fail.

Person responsible:

Chief academic officer of the faculty, study advisors of the departments, library.

030005P: Information Skills, 1 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Faculty of Technology

Arvostelu: 1 - 5, pass, fail

Opettajat: Koivuniemi, Mirja-Liisa, Sassali, Jani Henrik

Opintokohteen kielet: Finnish

Leikkaavuudet:

030004P Introduction to Information Retrieval 0.0 op

ECTS Credits:

1 credit.

Language of instruction:

Finnish/English

Timing:

2nd or 3rd year.

Learning outcomes:

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

Contents:

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

Learning activities and teaching methods:

The course involves training sessions (8h), web-based learning materials, exercises in the Optima learning environment and a final assignment on a topic of the student's own choice.

Recommended or required reading:

Web-based learning material from Toolbox of Reseach (<https://wiki oulu.fi/display/tor/1.1+Finding+scientific+information>)

Assessment methods and criteria:

Passing the course requires participation in the training sessions and successful completion of the course assignments.

Grading:

pass/fail

Person responsible:

Science and Technology Library Tellus, tellustieto (at) oulu.fi <http://www.kirjasto oulu.fi/index.php?id=738>

Other information:

<http://www.kirjasto oulu.fi/index.php?id=738>

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

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Language Centre

Opintokohteen kielet: Swedish

Leikkaavuudet:

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

Ei opintojaksokuvauksia.

900009P: Second Official Language (Finnish), 2 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Language Centre

Opintokohteen kielet: Finnish

Alternative

902011P: Technical English 3, 6 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Language Centre

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Proficiency level:[CEFR B2 - C1](#)**Language of instruction:**

English

Target group:**Students of all Engineering Departments (902011P Tekniikan englanti 3)****Students of the Department of Architecture (902011P Tekniikan englanti 3)****Person responsible:**Each department in the Technical Faculty has its own [Language Centre contact teacher](#) for questions about English studies.**Other information:**[See the Language Centre Study Guide, English, TTK](#)**903012P: Technical German 3, 6 op****Voimassaolo:** 01.08.1995 -**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Language Centre**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** German

Ei opintojaksokuvauksia.

488990A: Bachelor's Thesis / Environmental Engineering, 8 op**Voimassaolo:** 01.08.2007 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Process and Environmental Engineering**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

477990A Bachelor's Thesis / Process Engineering 8.0 op

Ei opintojaksokuvauksia.

488994A: MaturityTest/Bachelor of Science in Environmental Engineering/Technology, 0 op**Voimassaolo:** 16.03.2007 -**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Process and Environmental Engineering**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

900060A: Technical Communication, 2 op**Voimassaolo:** 01.08.2005 - 31.07.2021

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Language Centre

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900060A Technical Communication (OPEN UNI) 2.0 op

470218P Written and Oral Communication 3.0 op

Ei opintojaksokuvauksia.

Tutkintorakenteisiin kuulumattomien opintokokonaisuuksien ja -jaksojen kuvaukset

774301A: A Basic Course in Geochemistry, 6 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Geosciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Eero Hanski

Opintokohteen kielet: Finnish

ECTS Credits:

5 credits

Language of instruction:

finnish

Timing:

1st or 2nd spring

Learning outcomes:

The main objective is to provide students with the basic knowledge of various aspects of geochemistry .

Contents:

Geochemistry as a field of science; history of geochemistry; tasks and fields of geochemistry; origin of chemical elements; origins and structure of the Earth; meteorites; moon and planets; composition of earth's different spheres; geochemical differentiation; geochemical circulation; the geochemical characteristics and circulation of elements; geochemistry of disintegration and stratification; pH-Eh-diagrams; clays; carbonate sediments; geochemical processes; the main fields of geochemistry and their applications.

Learning activities and teaching methods:

32 h lectures, 12 h exercises

Recommended optional programme components:

780109P

Recommended or required reading:

Gill, Robin, Chemical Fundamentals of Geology, Chapman & Hall, London, 1996, 298 p. And Mason, B. & Moore, C.B.: Principles of Geochemistry, 4th Student Edition, J. Wiley, New York, 1982, p. 187-209.

Assessment methods and criteria:

examination

Grading:

1-5/fail

Person responsible:

E. Hanski

555360S: Administration, Organization and Education in Working Life, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Kisko, Kari Juhani

Opintokohteen kielet: English

Leikkaavuudet:

555371S Human Resource Management 5.0 op

555376S Organisational development 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish/English.

Learning outcomes:

To deal with the themes of organization theory, administration, supervision, education and human resources in working life.

Learning outcomes : After the course the student has an understanding of different organizations and how to work in organizations.

Contents:

For example: 1. Organization theory and models. 2. Interest groups of organization. 3. Organization culture. 4. Human resource management. 5. Organization development. 6. Exercises on the above themes.

Recommended or required reading:

Vartiainen, M. *Työn muutoksen työvälineet*. Otatiето OY 1994; Sarala, U. & Sarala, A. *Oppiva organisaatio - oppimisen, laadun ja tuottavuuden yhdistäminen*. 8. painos. Palmenia-kustannus 2003. Hatch, M. J. *Organization theory*. Oxford University Press, New York, USA 2006. Other literature reported at the beginning of the course.

477310S: Advanced Catalytic Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

Leikkaavuudet:

480360S Catalysts in Environmental Technology 5.0 op

ECTS Credits:

5 cr

Language of instruction:

English

Timing:

Implementation in 6th period every even year.

Learning outcomes:

Objective: The course reviews the recent methods and techniques for separation and purification of components and products e.g. in chemical, food, biotechnology industry. The course introduces new research innovations in separation processes.

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

Contents:

The course is divided into lectures given by visiting experts from different fields (industry, research institutes and universities) and seminars given by students and senior researchers. The lectures open up the newest innovations in separation and purification technologies. The lectures can include for example the following themes: Phenomena in Supercritical fluid extraction, Pressure-activated membrane processes, Reverse osmosis,

Nanofiltration, Ultrafiltration, Microfiltration, Pervaporation, Polymer membranes, Dialysis, Electrolysis and Ion-exchange, Forces for adsorption and Equilibrium adsorption isotherms, Sorbent materials and heterogeneity of surfaces, Predicting mixture adsorption, Rate processes in adsorption/adsorbers and adsorber dynamics, Cyclic adsorption processes, Temperature and pressure swing adsorption. Innovative separation methods, Phenomena integration, New hybrid materials as separation agents. Fluids and their application in gas extraction processes, Solubility of compounds in supercritical fluids and phase equilibrium. Extraction from solid substrates: Fundamentals, hydrodynamics and mass transfer, applications and processes (including supercritical water and carbon dioxide). Counter-current multistage extraction: Fundamentals and methods, hydrodynamics and mass transfer, applications and processes. Solvent cycles, heat and mass transfer, methods for precipitation. Supercritical fluid chromatography. Membrane separation of gases at high pressures. The topics of the course seminars will change annually depending on the research relevance.

Learning activities and teaching methods:

With the lectures the students will familiarize themselves to the latest research publications.

Recommended optional programme components:

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

Recommended or required reading:

The course literature will be chosen when the course is planned. Latest scientific research articles.

Additional literature: Separation Processes in the Food and Biotechnology Industries, Edited by: Grandison, A. S. & Lewis, M.J. 1996 Woodhead Publishing.

Assessment methods and criteria:

Seminars. Written examination. This course is proposed to be taken within the Research module.

Person responsible:

Professor Riitta Keiski

477607S: Advanced Control and Systems Engineering, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ikonen, Mika Enso-Veitikka

Opintokohteen kielet: Finnish

Leikkaavuudet:

470444S Advanced Control Methods 6.0 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish.

Timing:

Implementation in 4th-5th periods.

Learning outcomes:

To introduce advanced tools for control engineering as predictive control, adaptive control, multivariable control and neuro-fuzzy systems, which are commonly used applications in non-linear process modelling, control, plant optimisation, monitoring and scheduling.

Learning outcomes: After completing the course the student can model processes based on real-time measurements, build models for non-linear processes, and design control systems as optimization problems based on process models.

Contents:

1. Identifying processes using linear and non-linear models: recursive least squares methods, Kalman filtering, neural networks. 2. Model-based control: predictive control, multivariable control, adaptive control.

Learning activities and teaching methods:

Lectures and exercises.

Recommended or required reading:

Lecture handout; Ikonen, E. & Najim, K.: Advanced Process Identification and Control, Marcel Dekker Inc., New York 2002. 310 pp.

Assessment methods and criteria:

Examination and/or project work.

Person responsible:

Professor Enso Ikonen

488305S: Advanced Course for Biotechnology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Sanna Taskila

Opintokohteen kielet: English

Leikkaavuudet:

480450S Bioprocesses III 5.0 op

ECTS Credits:

5,0 credits

Language of instruction:

English

Timing:

Implementation in 2nd-3rd periods.

Learning outcomes:

This course aims to give the student a more profound and advanced perspective to major biotechnological applications with recombinant microbes and other current topics in the field.

Objectives: After completing this course, the student will be able to describe the most important recombinant protein and metabolite production processes used in biotechnology, e.g. production of proteins in bacteria and yeast, and in animal and plant cells. Further, the student will be able to compare between the different production processes and to choose techniques for different purposes.

Contents:

Stress responses in microorganisms. Recombinant protein production in bacteria. Fermentation and scale-up. Cell disruption and centrifugation. Protein folding. Protein purification. Recombinant protein production in yeasts and fungi, by animal cell culture technology, in transgenic animals, in plants and plant cultures. Metabolic engineering of pathways. Enzyme applications.

Learning activities and teaching methods:

Lectures 34 h + seminars and report depending of the amount of students. Homework.

Recommended optional programme components:

Prerequisites: The preceding courses by the Bioprocess Engineering Laboratory (especially 488302A Basics of biotechnology and 488304S Bioreactor Technology) or respective knowledge.

Recommended or required reading:

Will be announced at the lectures / seminars.

Assessment methods and criteria:

Lectures and intermediate exams (välikokeet) and/or final examinations, or seminars and report. Grade will be composed of homework, intermediate exams (välikokeet) and/or final examinations, or seminars and report.

Person responsible:

Professor Heikki Ojamo

488124S: Advanced Course in Hydrology, 5 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Björn Klöve

Opintokohteen kielet: English

Ei opintojaksokuvauksia.

555345S: Advanced Course in Product Development, 6 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Haapasalo, Harri Jouni Olavi

Opintokohteen kielet: English

Leikkaavuudet:

555351S Advanced Course in Product Development 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

English

Learning outcomes:

The course is divided into two parts, the first of which is focused on the creative design process and comparing between different product development methods. The second part focuses on commercialization of an idea. The aim of the course is to persuade students with basic technological knowledge, towards innovativeness, to critical thinking, and to understanding the significance and challenges of customer driven product development. Learning outcomes: After finishing the course, the student will be able to analyze product development processes and the work of a designer in context-linked development processes. The student will also be able to create methods for an efficient development process and its management.

Contents:

During the course create and systematic working methods as basis for product development are compared. The course covers the concepts of competence management, compares different product development methods and creates a link between research and development work in commercialization of innovations. The practical work of the course goes deeper into the planning phase of a product development process, its organization and controlling.

555385S: Advanced Course in Quality Management, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Jaakko Kujala

Opintokohteen kielet: Finnish

Leikkaavuudet:

555378S Seminar in industrial engineering and management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish/English

Learning outcomes:

To learn to apply different methods in decision making related to a company's strategy or operation. Learning outcomes: Upon completion the student can systematically analyse the challenges related to a company's business and develop alternative solutions to them.

Contents:

Changing content on topical subjects.

Learning activities and teaching methods:

Depending on the topic

Recommended optional programme components:

Bachelor in Industrial Engineering and Management or equivalent.

Recommended or required reading:

Depending on the topic

30002M: Advanced Information Skills, 1 op

Voimassaolo: 01.08.2009 -

Opiskelumuoto: Other Studies

Laji: Course

Vastuuyksikkö: Faculty of Science

Arvostelu: 1 - 5, pass, fail

Opettajat: Sassali, Jani Henrik

Opintokohteen kielet: Finnish

ECTS Credits:

1 ECTS credit

Language of instruction:

Finnish

Timing:

Recommend to degree students who are working on their diploma/master's thesis. The course unit is held once in the autumn and once in the spring semester.

Learning outcomes:

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

Contents:

Scientific information retrieval, evaluation of search results and information sources, information search on subject areas of diploma/master's thesis.

Mode of delivery:

Blended teaching: lectures, web-based learning material and exercises in Optima environment, personal guidance

Learning activities and teaching methods:

Lectures 6h, self-study 20h, personal guidance 1h

Recommended or required reading:

Parts from the following chapters of the Toolbox of Research: <https://wiki oulu.fi/display/tor/1.1+Finding+scientific+information>
<https://wiki oulu.fi/display/tor/1.3.1+Evaluation+based+on+academic+publishing>

Assessment methods and criteria:

Passing the course requires participation in the lectures (6h) and personal guidance and successful completion of the course assignments.

Grading:

pass/fail

Person responsible:

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

Other information:

<http://www.kirjasto oulu.fi/index.php?id=1250>

477002S: Advanced Practical Training, 3 op

Opiskelumuoto: Advanced Studies

Laji: Practical training

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Saara Luhtaanmäki

Opintokohteen kielet: Finnish

Leikkaavuudet:

477005S Advanced Practical Training 5.0 op

470069A Practice, extension 7.0 op

Learning outcomes:

Objective: To give a deeper and more detailed conception of the industrial area where the student will possibly work after graduation. Suitable tasks would be supervision tasks and R&D tasks. Students will land the jobs themselves.

Learning outcomes: During the advanced practical training the student is exposed to his/her working environment from the point of view of his/her studies and becomes acquainted with another possible future job or to a different assignment already in a familiar working environment. The student can identify the problems of the working environment and can solve them. The student can apply theoretical knowledge in practical tasks. The student identifies the tasks appropriate for the Master of Science in Technology at his/her workplace.

Contents:

Same areas as in the practical training.

Person responsible:

Student Advisor Saara Luhtaanmäki

488002S: Advanced Practical Training, 3 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Practical training

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Saara Luhtaanmäki

Opintokohteen kielet: Finnish

Leikkaavuudet:

477005S Advanced Practical Training 5.0 op

480098A Practice, extension 7.0 op

ECTS Credits:

3,0 cr

Timing:

Summer (recommended)

Learning outcomes:

Objective: To give a deeper and more detailed conception of the areas where the student will possibly work after graduation. Suitable tasks would be supervision tasks and R&D tasks. Students will land the jobs themselves.

Learning outcomes : During the advanced practical training the student is exposed to his/her working environment from the point of view of his/her studies and becomes acquainted with another possible future job or with a different assignment already in a familiar working environment. The student can identify the problems associated with the working environment and can solve them. The student can apply theoretical knowledge in practical tasks. The student identifies the tasks appropriate for the Master of Science in Technology at his/her workplace.

Contents:

Same areas as in the practical training.

Person responsible:

Student advisor Saara Luhtaanmäki

477206S: Advanced Process Design, 6 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ahola, Juha Lennart

Opintokohteen kielet: English

Leikkaavuudet:

477223S Advanced Process Design 5.0 op

480350S Advanced Process Design 5.0 op

Language of instruction:

English

Timing:

Periods 5-6.

Learning outcomes:

Objective: The student learns how to adapt the skills from previous courses in a process design project.

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.

Learning activities and teaching methods:

Design projects in small groups.

Recommended optional programme components:

Objectives of 477203A Process Design

Recommended or required reading:

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

Assessment methods and criteria:

Project work with reporting.

Person responsible:

University Lecturer Juha Ahola

477311S: Advanced Separation Processes, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

ECTS Credits:

5 cr

Language of instruction:

English

Timing:

Implementation in 6th period every even year.

Learning outcomes:

Objective: The course reviews the recent methods and techniques for separation and purification of components and products e.g. in chemical, food, biotechnology industry. The course introduces new research innovations in separation processes.

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

Contents:

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

Learning activities and teaching methods:

With the lectures the students will familiarize themselves to the latest research publications.

Recommended optional programme components:

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

Recommended or required reading:

The course literature will be chosen when the course is planned. Latest scientific research articles.

Additional literature: Separation Processes in the Food and Biotechnology Industries, Edited by: Grandison, A. S. & Lewis, M.J. 1996 Woodhead Publishing.

Assessment methods and criteria:

Seminars. Written examination. This course is proposed to be taken within the Research module.

Person responsible:

Professor Riitta Keiski

555324S: Advanced Supply Chain Management, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Kess, Pekka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

55531S Supply Network Management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish

Learning outcomes:

Learning outcomes: After completing the course student knows the key concepts of supply chain management and can explain these. The student can describe the structures of supply chains and can explain the meaning of management in the performance of supply chain operations. The student can analyse the supply chain activities in a company and can produce improvement proposals based on the analysis. After the course the student can take part in the supply chain development in the role of an expert.

Contents:

Demand Supply Chain Management in general. Networked production systems. E-business in demand supply chains.

Learning activities and teaching methods:

The course includes lectures and team work.

Target group:

Main target groups are the Students of Industrial Engineering and Management as well as those students in the departments of Mechanical Engineering and Process and Environmental Engineering who have the orientation to Industrial Engineering and Management. Other engineering students are accepted.

Recommended optional programme components:

555224A Tuotannon ja logistiikan menetelmät.

Recommended or required reading:

Lecture notes. Other material will be informed during the lectures.

Assessment methods and criteria:

Course is completed and assessed by team work report and its presentation in the closing seminar.

Grading:

fail ... 1...5/5

488204S: Air Pollution Control Engineering, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

ay488204S	Air Pollution Control Engineering (OPEN UNI)	5.0 op
488213A	Sources and control of air pollution	5.0 op
480380S	Air Protection Techniques	5.0 op

Learning outcomes:

To familiarise the student with the effects of air pollution, industrial emissions to air and the control.

Legislation of air pollution.

Learning outcomes: The student is able to explain what kind of air emissions result from certain industries and power plants and can explain their environmental impacts. The student is able to explain the common air pollution control systems for different emissions (SO₂, NO_x, VOC, CO₂, dust) and is able to dimension air pollution cleaning devices. He/she is able to describe how air emissions are measured. The student is able to describe the main laws related to air emission control.

Contents:

Effects of pollution on the atmosphere. Acid rain. Climate change. Ozone. Effects of pollution on health and buildings. Legislation. Measurement of pollution. Long - range transport and diffusion models. Control of emissions, VOC emissions, SO_x emissions, NO_x emissions, heavy metals, dioxins, freons.

Recommended optional programme components:

The courses Introduction to Process Engineering, Introduction to Environmental Engineering and General and Inorganic Chemistry recommended beforehand.

Recommended or required reading:

Lecture handout. 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.

Person responsible:

University researcher Mika Huuhtanen

488306S: Applied Microbiology, 7 op

Voimassaolo: 01.08.2005 - 31.07.2014

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Sanna Taskila

Opintokohteen kielet: Finnish

Leikkaavuudet:

480420A	Applied Microbiology III	2.0 op
480421A	Applied Microbiology IV	5.0 op

ECTS Credits:

7,0 credits

Language of instruction:

Finnish (English)

Timing:

Implementation in periods 1st-3rd.

Learning outcomes:

After completing this course, the student will be able to operate in a microbiological laboratory. He/she will be able to handle and cultivate microbes and to apply the methods to different microbes. Under supervision, the student will be able to construct a scientific research plan and to analyse and report orally and in written form the results from his/her practical research exercise.

Contents:

Experimental work in the area of applied microbiology. Each student will be personally supervised over three weeks by researchers from the laboratory and the training will contain at least three different methods. In the end of the practicum, the student will provide an extended written report, including a literature study and the practical results, and will orally present and discuss these results in a seminar.

Learning activities and teaching methods:

Supervised practical laboratory exercises, written report, literature search, and seminar. Teaching 50 h.

Recommended optional programme components:

Prerequisites: the bachelor level courses by the Bioprocess Engineering Laboratory or respective knowledge.

Recommended or required reading:

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

Assessment methods and criteria:

Grade will be composed of supervised practical laboratory exercises, written report, literature search, and seminar.

Person responsible:

Sanna Taskila

477508S: Automation in Metallurgical Industry, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: English

ECTS Credits:

5,0 cr

Language of instruction:

English

Timing:

Implementation in 5th period.

Learning outcomes:

To familiarise the student with the models and control in metallurgical industry. Also to examine the typical automation solutions in metallurgical industry.

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, rolling mill. Model solutions by special-purpose simulators. Also some special measurements are introduced

Learning activities and teaching methods:

Lectures, practical (home) exercises. Continuous evaluation possible.

Person responsible:

Professor Kauko Leiviskä

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

Voimassaolo: 01.08.2005 - 31.07.2021

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: English

Leikkaavuudet:

470338S Process Control in Pulp and Paper Industry 3.5 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 3rd period.

Learning outcomes:

To familiarise the student with the most important process control targets in pulp and paper industry and used control strategies.

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

Contents:

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

Recommended optional programme components:

Course Pulp and Paper Technology recommended beforehand

Recommended or required reading:

Leiviskä, K.: Process Control. Book 14. Papermaking Science and Technology Series. Fapet Oy 1999. Separate material on applications of intelligent systems in paper industry in web. Additional literature : Other literature, articles distributed during the course.

Assessment methods and criteria:

Book examination, literature report.

Person responsible:

Professor Kauko Leiviskä

488407S: BEE Foreign Excursion to the Barents Region, 2 op

Voimassaolo: 01.01.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kirsi *Marita Puikkonen, Huuhtanen, Mika Ensio, Heino, Jyrki Juhani

Opintokohteen kielet: English

477701A: Basic Course in Geology, 4 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Gehör

Opintokohteen kielet: Finnish

Leikkaavuudet:

477710A Basic Course in Geology 5.0 op

ECTS Credits:

4,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 1st period.

Learning outcomes:

This course will give the student the basic information on geology and mineralogy he/she will need as prerequisite knowledge in the more advanced mining engineering subject studies.

Learning outcomes: After completing this course, the student can identify macroscopically the most common rock species and minerals and can explain the procedures creating them. The student can use geological terminology and concepts and is able to search respective information.

Contents:

Crystals, the characteristics of crystalline substances; minerals and their physical and chemical characteristics; classification and macroscopic identification of different minerals and rocks species.

Learning activities and teaching methods:

Lectures and practical exercises.

Recommended optional programme components:

Bachelor level studies in process engineering or respective knowledge.

Assessment methods and criteria:

Final examination

Person responsible:

Ph.D. Seppo Gehör

555261A: Basic Course in Occupational Psychology, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Kisko, Kari Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

555264P Managing well-being and quality of working life 5.0 op

ay555261A Basic Course in Occupational Psychology (OPEN UNI) 3.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish.

Learning outcomes:

To introduce the aim, the contents and the methods of occupational and organisational psychology.

Learning outcomes: After the course the student has an understanding of people at work. He understands what means individual differences, work motivation, stress in the workplace, groups and teams at work and so on.

Contents:

For example: 1. Models of man. 2. The history of occupational psychology. 3. The aim of occupational psychology. 4. The psychological structure of work and organization. 5. The research and evaluation of work and organisation. 6. The development of work and organisation.

Recommended or required reading:

Arnold, J. *Work Psychology: Understanding Human Behavior in the Workplace*. Prentice Hall . Luoma, J. (edited): *Johdatus työpsykologiaan* , Otatiето 2000. Other literature reported at the beginning of the course.

555240A: Basic Course in Product Development, 3 op

Voimassaolo: 01.06.2007 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Haapasalo, Harri Jouni Olavi

Opintokohteen kielet: Finnish

Leikkaavuudet:

555242A Product development 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish

Learning outcomes:

This study module introduces product development, innovations and technology management in a company environment. Basic course in product development provides fundamental understanding over tools and frameworks that can be used for analysing and managing products, innovations, and technology development. The aim is to create a connection between product development and other company functions.

Learning outcomes: After this study module, a student is capable of explaining the role of product development as a company function. The student understands the difference between innovation activities and systematic product development, and knows the difference between different phases of product development process and its activities. Additionally, the student is able to define the meaning of other company functions to product development activities.

Contents:

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

Learning activities and teaching methods:

The course includes lectures and compulsory course work. The course work entails simulating product development in practical situations.

Recommended or required reading:

Study material include: handouts, course work, and a collection of articles. Ulrich, K. & Eppinger, S. (2008) 'Product Design and Development'. McGraw-Hill. 358 p.

Assessment methods and criteria:

Final exam.

Grading:

1-5/fail

555281A: Basic Course of Quality Management, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Osmo Kauppila, Jaakko Kujala

Opintokohteen kielet: Finnish

Leikkaavuudet:

555286A Process and quality management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish

Learning outcomes:

The objective of the course is to familiarise the student on managing production processes from a point of statistical process control.

Learning outcomes : Upon completion the student can explain the essential concepts of quality management and recognizes the significance of quality in different working environments. The student gains basic level skills for applying the methods of statistical process control. The student is able to solve problems of production process by using quality management problem solving methods.

Contents:

The significance of quality to a company, quality in open and closed systems, quality costs, quality tools and methods of statistical process control and the use of them in practical problem solving, basics of total quality management.

Learning activities and teaching methods:

Lectures and exercise are integrated. A group study is made during the course. The final grade is determined by the group study and a final exam.

Recommended or required reading:

Lecture materials, lecture handout and exercise book

740148P: Biomolecules, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Biochemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Lloyd Ruddock

Opintokohteen kielet: English

Leikkaavuudet:

ay740157P Basic biochemistry 1: Biomolecules (OPEN UNI) 4.0 op

ay740152P Basic biochemistry 1: Biomolecules (OPEN UNI) 5.0 op

740143P Biomolecules for Biochemists 8.0 op

740147P Biomolecules for Bioscientists 8.0 op

ECTS Credits:

5 credits

Language of instruction:

English

Timing:

autumn-spring

Learning outcomes:

Upon successful completion students should:

- Have a basic understanding of the composition, structure and function of the major groups of biomolecules in cells; nucleic acids, proteins, carbohydrates and lipids and the forces that modulate their function.
- Have an appreciation of the requirement to contextualize and critically evaluate information.

Contents:

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

Learning activities and teaching methods:

30 h lectures, plus exercises

Target group:

Minor subject students

Recommended or required reading:

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

Grading:

1-5/fail

Person responsible:

Lloyd Ruddock

Other information:

This module is the same as Biomolecules for Biochemists except that it contains no practical component.

488307S: Bioprocess Engineering, 7 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Narendar Khatri, Mari Ylianttila, Mursula, Anu Mari, Johanna Panula-Perälä

Opintokohteen kielet: Finnish

Leikkaavuudet:

488322S	Bioprocess Engineering	5.0 op
480455S	Bioprocess Engineering Seminar	3.5 op
480481S	Bioprocess Engineering, practise work	5.0 op

ECTS Credits:

7,0 credits

Language of instruction:

Finnish (English)

Timing:

Implementation in 4th-6th periods.

Learning outcomes:

In this course students will learn key methods of microbial production (e.g. fermentation, recombinant protein production and purification). Practice in research project planning, in different methods for biotechnology, and in report writing and seminar presentation will train the student for conducting a scientific research project.

Learning outcomes: After completing this course, the student will be able, under supervision, to prepare a research plan for his/her practical laboratory training research project. The student will be able to apply different biotechnological methods used in the recombinant protein production, in fermentation processes and in protein purification. He/she will be able to analyse the research results and to present them both in written and oral form.

Contents:

Each student will be personally supervised over three weeks by researchers from the laboratory. In the end of the practicum, the student will provide an extended written report, including a literature study and the practical results, and will orally present and discuss these results in a seminar.

Learning activities and teaching methods:

Supervised practical laboratory exercises, written report, literature search, and seminar. Teaching 50 h.

Recommended optional programme components:

The bachelor level and previous master level courses by the Bioprocess Engineering Laboratory or respective knowledge.

Recommended or required reading:

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

Assessment methods and criteria:

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

Person responsible:

University teacher Johanna Panula-Perälä

488304S: Bioreactor Technology, 6 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Heikki Ojamo, Johanna Panula-Perälä

Opintokohteen kielet: English

Leikkaavuudet:

488321S Bioreactor technology 5.0 op

480431S Bioprocesses II 5.0 op

ECTS Credits:

6,0 credits.

Language of instruction:

English

Timing:

Implementation in periods 1st-2nd.

Learning outcomes:

The course provides the student the basics of bioreactor technology. It specifically focuses on bioreactor performance and operation and on the kinetics related to microbial growth, product formation and function of enzymes.

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 sterilisation. The student will be able to apply different mathematical formulas for biocatalysis and for the bioreactor performance and use those to plan and analyse bioprocesses. The student will also be able to produce, analyse and interpret microbial growth curves and other data from bioprocesses.

Contents:

The biotechnological process: General process schemes, batch, fed batch and continuous processes, biocatalysts and raw materials. Reactor design and instrumentation. Sterilisation: kinetics of heat inactivations and practical implementations of the sterilization. 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. Power consumption. Scale-up and scale-down.

Learning activities and teaching methods:

34 h lectures + 6 h exercises, homework.

Recommended optional programme components:

The bachelor level courses by the Bioprocess Engineering Laboratory or respective knowledge.

Recommended or required reading:

Lectures: Lecture hand out; Doran, P. M. 1995. Bioprocess engineering principles. Academic Press. London. 0-12-220855-2. Supplementary material: Enfors, S.-O., Häggström, L. 2000. Bioprocess technology fundamentals and applications. Royal Institute of Technology. Stockholm. 91-7170-511-2; Aittomäki, E., Eerikäinen, T., Leisola, M., Ojamo, H., Suominen, I., von Weymarn, N. 2002. Bioprosessiteknikka. 1 ed. WS Bookwell Oy. Porvoo. 951-0-26995-6; Biotechnology (Vol 1-12): a Multi-Volume Comprehensive Treatise. Toim. H.-J. Rehm and G. Reed, Weinheim, Wiley-VCH. 1991.

Assessment methods and criteria:

Lectures, exercises, intermediate exams (välikokeet) and/or final exam, homework. Grade will be composed of intermediate exams (välikokeet) and/or final exam, exercises and homework.

Person responsible:

Professor Heikki Ojamo

477208S: Biorefineries, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tanskanen, Juha Petri

Opintokohteen kielet: Finnish

Leikkaavuudet:

477224S Biorefineries 5.0 op

ECTS Credits:

3 cr

Language of instruction:

Finnish

Timing:

Period 4.

Learning outcomes:

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

Contents:

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

Learning activities and teaching methods:

Lectures and small group exercises. Occurring every other year.

Assessment methods and criteria:

Examination and other evaluation methods.

Person responsible:

Professor Juha Tanskanen

782627S: Chemical Applications in Hazardous Waste Management and Environmental Technology, 4 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Chemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Toivo Kuokkanen

Opintokohteen kielet: Finnish

ECTS Credits:

4 credits

Language of instruction:

Finnish

Timing:

4th or 5th spring. The course is lectured every other year, next time during the spring 2013.

Learning outcomes:

After completing this course, the student should have acquired knowledge and understanding of theory and practice with chemical applications in utilization and disposal of chemical wastes, especially hazardous wastes as well as with new chemical environmental technology

Contents:

Principles and activities in management of hazardous and other chemical wastes, modern treating methods of chemical wastes, new chemical methods and technologies in the utilization of chemical wastes, especially hazardous wastes

Learning activities and teaching methods:

30 hours of lectures + seminar + home work

Target group:

Chemistry, optional

Recommended optional programme components:

Basic Principles in Green Chemistry (780372A)

Recommended or required reading:

Clark, J.H.: Chemistry of Waste Minimization, Blackie Academic & Professional, Glasgow 1995, partly and material handed out by the lecturer.

Assessment methods and criteria:

Final examination

Grading:

1-5/fail

Person responsible:

Doc. Toivo Kuokkanen

477204S: Chemical Engineering Thermodynamics, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Language of instruction:

Finnish

Timing:

Period 1.

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.

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

Person responsible:

Professor Juha Tanskanen

477209S: Chemical Process Simulation, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jani Kangas

Opintokohteen kielet: English

Ei opintojaksokuvauksia.

477104S: Chemical Wood Processing, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Ämmälä

Opintokohteen kielet: Finnish

Leikkaavuudet:

477123S Chemical processing of biomasses 5.0 op

470111S Woodpulp Manufacture 2.5 op

ECTS Credits:

3,0 credits

Language of instruction:

Finnish

Timing:

Implementation in period 1 every other year.

Learning outcomes:

Objective: To deepen knowledge about chemical pulping and give an insight into biorefining .

Learning outcomes: Upon completion of the course, a student should be able to identify unit operations of chemical pulping process and can explain their operational principles. The student is able to evaluate the effect of raw material properties and the importance of different unit operations on quality of the end product. In addition, the student is able to identify the cooking and bleaching chemicals used in chemical pulping and can describe the most important chemical reactions occurring in the process. In addition, the student is able to identify chemicals and products of wood based biorefinery.

Contents:

Raw materials, fundamentals of chemical pulping, circulation of chemicals in kraft pulping, bleaching of pulp.

Wood- and nonwood-based biorefining.

Learning activities and teaching methods:

Lectures. 30 h. Excursion to a pulp mill.

Recommended optional programme components:

Pulp and Paper Technology 477103A

Recommended or required reading:

Book series: Fapet Oy. Papermaking Science and Technology, book 6 (A ja B). Chemical pulping. A 693 s. ja B 497 s. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:

Exam. Literature exam possible for foreign students.

Person responsible:

Postdoctoral Research Fellow Ari Ämmälä

555366S: Chemical and Physical Hazards in Industrial Environments, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Väyrynen

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish.

Learning outcomes:

To familiarise students with the theoretical background of the chemical and physical hazards in industrial environments.

Learning outcomes: After the course the student is capable of identifying chemical, physical and biological hazards of working environment. He has the basic skills to plan measurements as well as document and analyze results of measurements. In addition, the student is able to use the most common sound level meters and photometer.

Contents:

The main emphasis is on learning measurement, monitoring and control principles and practices. EU-directives. Lighting. Occupational diseases. Safety management. Occupational health services.

Recommended optional programme components:

555260P Basic course in occupational safety.

Recommended or required reading:

Työhygieeniset mittaukset, Työterveyslaitos 2007; Starck, J. et al. *Työhygieniä*, Työterveyslaitos 2008; Other literature reported at the beginning of the course.

555365S: Computer-Aided Methods in Ergonomics, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Väyrynen

Opintokohteen kielet: English

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish/English

Learning outcomes:

The course familiarizes the student with some of the internationally well-known pieces of CAD-software for ergonomics design and evaluation.

Learning outcomes: After completion of the course students are able to use the key ergonomic design principles of computer-assisted programs and knows the latest scientific development in the field.

Contents:

The principles and methods of Computer-Aided Design methods in ergonomics

Recommended or required reading:

Landau, K. (ed.): *Ergonomic Software Tools in Product and Workplace Design*, Verlag ERGON GmbH Stuttgart 2000. 275 p.; Manuals, brochures and www-sites of software examples; Väyrynen, S.: *Suunnittelijan ergonomia*. Soveltavan ergonomian laboratorio, 1996. 199 p.; Väyrynen, S.: *Examples of computer-aided design, modeling and learning applications in ergonomics*. In: Course book on gerontechnology, COST A5, *Normal and pathological ageing and the impact of technology*, selected topics (Ed. By S-L. Kivelä, K. Koski & J. Rietsema). Eindhoven University of Technology & University of Oulu, 1995. pp. 114-124.

Other information:

Course is taking place only every second year starting in 2004

555363S: Creativity at Work and in Product Development, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Kisko, Kari Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay555363S Creativity at Work and in Product Development (OPEN UNI) 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish

Learning outcomes:

The course aims at raising the student's interest in seeing the objects that need development in the working environment. The course also provides the methods to improve these objects.

Learning outcomes : After the course the student understands what is creativity and how to use various methods of creative work and how to get new ideas and how to develop new products.

Contents:

The basic elements of creativity will be introduced to students through real life examples. Training various methods of creative work plus completing a development project and presenting the results will be accomplished in teams.

Recommended or required reading:

Luova työote - tuottava työ. Työhallinnon julkaisu 345. Työministeriö 2005. Rajala, H-K. & Kisko, K. *Yhdessä paja paremmaksi*. Teknologiateollisuus ry. 2005. Langford, J. & McDonagh, D. (edited) *Focus groups - supporting effective product development*. London: Taylor & Francis 2003. Other literature reported at the beginning of the course.

464088S: Diagnosis of Machine Condition, 8 op

Voimassaolo: - 31.07.2021

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Lahdelma, Sulo Olavi

Opintokohteen kielet: Finnish

Leikkaavuudet:

462111S Machine diagnostics 10.0 op

Language of instruction:

Finnish

Learning outcomes:

The objective of the course is to provide the student with more in-depth knowledge of machine diagnostics after the Maintenance Technology Course. Skills for independent diagnosis are developed through a variety of exercises.

Learning outcomes: After the course, the student is able to evaluate machine conditions independently using the most common diagnostics measuring instruments and identify potential fault types. He/she will recognize the connection between machine condition and product quality. The student is able to apply the most common signal processing methods and features used in condition monitoring and use the standards of this field. He/she is also able to draw up a measurement plan, carry out the measurements and report the measurement results.

Contents:

The course discusses ways of diagnosing typical faults occurring in power plants or the process and steel industry and diagnostic means for improving reliability, product quality, environmental protection and the modernization of machines.

Learning activities and teaching methods:

The course consists of lectures arranged during the 1st period and exercises during the periods 1 and 2. The grade for the course is based on a final examination.

Recommended optional programme components:

The Maintenance Technology Course is recommended.

Recommended or required reading:

Klein, U., Schwingungsdiagnostische Beurteilung von Maschinen und Anlagen. Düsseldorf, Verlag Stahleisen GmbH, 2003. (In German); Lahdelma, S., Lecture notes: Diagnosis of machine condition, 2008. (In Finnish); English material is also available.

Supplementary reading: Rao, B., Handbook of Condition Monitoring. Oxford, Elsevier Advanced Technology, 1996.; PSK-käsikirja 3 – Vibration measurement in condition monitoring. Helsinki, PSK Standardisointiyhdistys ry, 2009. Most standards are available in Finnish and in English.

477605S: Digital Control Theory, 4 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Honkanen

Opintokohteen kielet: Finnish

Leikkaavuudet:

477624S Control System Methods 5.0 op

470453S Digital Control Theory 5.0 op

ECTS Credits:

4,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 2nd-3rd periods.

Learning outcomes:

Introducing the computer controlled, sampled data systems. Acquiring the knowledge of designing and tuning discrete-time control systems.

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

Contents:

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

Learning activities and teaching methods:

Lectures and exercises

Recommended optional programme components:

Courses 470602A and 470603A are recommended beforehand.

Recommended or required reading:

Lecturer's note. Landau, I. & Zito, G. (2005) Digital Control Systems, Springer. 485 pp. Åström, K.J. & Wittenmark, B. (1984, 1997) Computer Controlled Systems: Theory and Design. Prentice-Hall International. 544 pp.

Assessment methods and criteria:

The course concludes in a written exam; to request an exam in English, contact the lecturer via email beforehand.

Person responsible:

University teacher Seppo Honkanen

488103A: Environmental Impact Assessment, 4 - 8 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Björn Klöve

Opintokohteen kielet: English

Leikkaavuudet:

488133A Environmental Impact Assessment 5.0 op

ay488103A Environmental Impact Assessment (OPEN UNI) 5.0 op

480170S Environmental Impact Assessment and Diminishing Harmful Effects in Water Resource Management 5.0 op

ECTS Credits:

5,0-8,0 cr

Language of instruction:

English

Timing:

Implementation in 1st-5th periods.

Learning outcomes:

To provide a broad and multidisciplinary and sustainable approach to environmental impact assessment (EIA).
Learning outcomes To student will know the EIA process and the different methods used in environmental impact assessment.

Contents:

EIA process and legislation, environmental change, principles and assessment methods in ecology, hydrology, economics and social sciences.

Learning activities and teaching methods:

The course is organised in a co-operation with faculty of Technology, Economics, Social Sciences, Biology and the Thule institute. The course contains lectures (42 h) and an assignment.

Recommended optional programme components:

Introduction to Environmental Engineering or comparable knowledge.

Recommended or required reading:

Environmental Impact Assessment: Cutting Edge for the Twenty-First Century (Gilpin A, 1995, ISBN 0-521-42967-6). Lecture handout and other materials delivered in lectures.

Assessment methods and criteria:

The course includes five modules, which are evaluated separately (with the scale 1-5). Assessment methods vary including learning diaries and different kind of assignments.

Person responsible:

Professor Björn Klöve

Other information:

Lectures are given in every second years.

488405S: Environmental Issues in the Barents Region, 5 op

Voimassaolo: 01.01.2009 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eva Pongracz

Opintokohteen kielet: English

ECTS Credits:

5,0 cr

Language of instruction:

English

Timing:

Implementation in 6th period.

Learning outcomes:

To provide the student with a comprehensive understanding of the environmental landscape of the Barents region, the impacts of past activities, and projections of future economic and social development.

Contents:

Northern land-use, Diversity of the northern environment, Land-use and socio-economical changes, Sustainable use of northern resources (forest resources, minerals, Barents Sea resources), Global change in the north, Industry and pollution (prevention and remediation), Socio-economic issues (health, indigenous cultures, languages).

Learning activities and teaching methods:

Contact teaching, field-trip and course assignments.

Location: Oulanka Research Station.

Recommended or required reading:

Material provided during and prior to the course.

Person responsible:

D.Sc. (Tech) Eva Pongrácz

488205S: Environmental Load of Process Industry, 4 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

ay488215S	Industry and Environment (OPEN UNI)	5.0 op
488215S	Industry and Environment	5.0 op
488221S	Environmental Load of Industry	5.0 op
480314S	Control of Environmental Load from Processes of Pulp and Paper Industry	2.5 op
480315S	Control of Environmental Load from Processes of Metallurgical Industry	2.5 op

ECTS Credits:

4,0 cr

Language of instruction:

Finnish or english

Timing:

Implementation in 6th period.

Learning outcomes:

To familiarise the student with the environmental impacts in process industry such as air pollution, waste water and solid waste in greater detail. The student will also know about environmental leadership in an industrial plant.

Learning outcomes: The student is able to identify the essential features of the environmental load in wood processing, chemical and metallurgical industry. He/she is able to explain the type, quality, quantity and source of emissions. The student is able to apply the main emission control systems and techniques in different industrial sectors. He/she has the skills to apply BAT-techniques in emission control. The student is able to explain the environmental management system of an industrial plant and is able to apply it to an industrial plant.

Contents:

Effluents: types, quality, quantity, sources. Unit operations in managing effluents, comprehensive effluent treatment. Environmental management systems, environmental licences, environmental reporting and BAT.

Recommended optional programme components:

The courses Introduction to Process Engineering, Introduction to Environmental Engineering, Air Pollution Control Engineering and Water and Wastewater Treatment recommended beforehand.

Recommended or required reading:

Material represented in lectures.

Person responsible:

University lecturer Mika Huuhtanen

555364S: Ergonomics, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Väyrynen

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish.

Learning outcomes:

The course familiarises the student with the fundamental principles of ergonomics.

Learning outcomes: After the completion of the course students are able to present and justify human artefacts and the interaction of the essential principles for the production and use of products. He can choose the methods which will enhance the employees safety, health, well-being to achieve work satisfaction. Still, he can develop and design products in the production according to physical, cognitive and organizational ergonomics.

Contents:

The anthropometrics, biomechanics, gerontechnology, work physiology, cognitive psychology and organisational and participative approaches. The principles of design and measurement (CAD, simulation, participative design). Usability.

Recommended or required reading:

Väyrynen, S, Nevala, N & Päivinen, M (2004), *Ergonomia ja käytettävyys suunnittelussa*.

Teknologiaeollisuus. 336 s . **Additional literature:** Bridger, R. (2009). *Introduction to ergonomics* . 3rd edition. CRC Press ; SFS-ergonomiastandardit (EN-ISO, www.sfs.fi), Copies from lectures.

477111S: Excursion to Pulp and Paper Research Institute, 1 op

Voimassaolo: 01.08.2005 - 31.07.2013

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Ämmälä

Opintokohteen kielet: Finnish

ECTS Credits:

1,0 credits

Language of instruction:

Finnish

Timing:

Implementation during period 5-6.

Learning outcomes:

Objective: to give an insight into R&D of pulp and paper industry.

Learning outcomes: Upon completion of the course, a student is able to evaluate based on excursion what kind of knowledge is needed to work for that research institute or industrial plant.

Contents:

Excursion to a Finnish research center and/or a mill in the field of forest industry.

Learning activities and teaching methods:

Excursion to a Finnish research center and/or a mill in the field of forest industry.

Recommended optional programme components:

Participation in the course is possible only those students having major in the Advanced Special Module of Pulp and Paper Technology

Assessment methods and criteria:

Participating to excursion and written journey report.

Person responsible:

Postdoctoral Research Fellow Ari Ämmälä

555367S: Exercises in Work Science, 6 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Väyrynen

Opintokohteen kielet: Finnish

Leikkaavuudet:

555379S Research Project in Industrial Engineering and Management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish.

Learning outcomes:

The various previous courses on safety, ergonomics and maintenance will give the knowledge which will be applied to real industrial problems in this course.

Learning outcomes: After the course the student is able to apply know-how and methods to the working environment and organizational development. He knows how to utilize the above-mentioned principles of academic knowledge, jobs and businesses in planning and management situations. Students are able to respond to current practice, work system or a product development challenge, methodical and evidence-based equipment.. The students can also take advantage of research-based approach to a research problem in a company, research organization, or in a R & D project.

Contents:

The participants are familiarized with systematic methods presented in well-known textbooks or research reports. Computer-aided systems.

Recommended or required reading:

Reported at the beginning of the course.

477041S: Experimental Design, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: English

ECTS Credits:

5 cr

Person responsible:

Professor Kauko Leiviskä

477413S: Experimental Research in Extractive Metallurgy, 10 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Tanskanen

Opintokohteen kielet: Finnish

ECTS Credits:

10 cr

Language of instruction:

Finnish (English if necessary).

Timing:

Implementation in 4th-6th periods.

Learning outcomes:

Objective: The course aims to increase skills of students to make laboratory scale research and development projects concerning high temperature research in extractive metallurgy. Team work, project managing and reporting skills are also aimed to be developed.

Learning outcomes: Students passing the course are familiar with the most important experimental and analytical methods used in the laboratory scale research of materials and metallurgical processes. Students can determine and separate research problems to reasonable pieces, collect the background information, select the reasonable methods and make the research and reporting on planned schedule. Additionally, students can

observe the metallurgical phenomena and their interconnections and consequences. It should also be noted that the contents of the course are under continuous development and therefore more detailed learning outcomes are given each year at the beginning of each course.

Contents:

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

Learning activities and teaching methods:

Group exercises and contact-education that supports these exercises.

Recommended optional programme components:

Knowledge and skills corresponding the knowledge and skills that are obtained from the Bachelor-level-studies in the programme of process or environmental engineering are required as prerequisites.

Recommended or required reading:

Material will be distributed during lectures and exercises.

Assessment methods and criteria:

Group-exercises and reports.

Person responsible:

University teacher Pekka Tanskanen.

477606S: Fault Diagnosis and Process Performance Analysis, 2 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hiltunen, Jukka Antero, Harri Aaltonen

Opintokohteen kielet: Finnish

Leikkaavuudet:

477623S	Process Information Systems	10.0 op
477610S	Process Information Systems	5.0 op

ECTS Credits:

2,0 cr

Language of instruction:

Finnish.

Timing:

Implementation in 4th-5th periods.

Learning outcomes:

To introduce the student to the methods used in fault diagnostics and process performance analysis. The student will have a good level of readiness for developing diagnostic systems especially for the needs of process technology.

Learning outcomes: The period of study completed, the student can implement processes running and maintenance of performance-enhancing systems.

Contents:

Model- and data-based diagnostic methods, measurement validation, key figure calculation, clustering and classification, process performance assessment and follow-up, application examples.

Learning activities and teaching methods:

Lectures and exercises.

Recommended optional programme components:

Courses Introduction to Automation Engineering, Process Automation Systems, Control System Analysis and Control System Design or equivalent information recommended beforehand.

Recommended or required reading:

Lecture handout. Additional literature will be announced later.

Assessment methods and criteria:

Examination or project works.

Person responsible:

University teacher Harri Aaltonen

477705S: Field Course in Economic Geology, 2 op

Voimassaolo: - 31.07.2013

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Gehör

Opintokohteen kielet: Finnish

ECTS Credits:

3,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 6th period.

Person responsible:

Ph.D. Seppo Gehör

477305S: Flow Dynamics, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department 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 cr

Language of instruction:

Finnish

Timing:

Implementation in 2nd period.

Learning outcomes:

Objective: To familiarise the student with mathematical modelling of flow phenomena using computational fluid dynamics (CFD).

Learning outcomes: After completing the course the student is able to formulate the partial differential equations describing flow and to solve these equations in systems with simple geometry using difference, finite element and finite volume methods. 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 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. Experimental fluid dynamics.

Contents:

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

Learning activities and teaching methods:

Lectures and compulsory exercise done in small groups.

Recommended optional programme components:

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

Recommended or required reading:

Anderson J.D.: Computational Fluid Dynamics, McGraw-Hill, 1995, 608 p. Hämäläinen J. & Järvinen J.: Elementtimenetelmä virtauslaskennassa, CSC – Tieteellinen laskenta Oy, 1994, 212 p. Versteeg, H.K. & Malalasekera, W.: An Introduction to Computational Fluid Dynamics, Longman Scientific and Technical, 1995, 257 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.: Numeeriset menetelmät. CSC – Tieteellinen laskenta Oy, 1993, 236 p; Rathakrishnan, E.: Instrumentation, Measurements, and Experiments in Fluids, 2007, 492 p.

Assessment methods and criteria:

Examination and exercise.

Person responsible:

Laboratory manager Esa Muurinen

477604S: Fundamentals of PID Control, 3 op

Voimassaolo: 01.08.2005 - 31.07.2013

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Manne Tervaskanto

Opintokohteen kielet: Finnish

Leikkaavuudet:

470463S2 Design Software in Automation 5.0 op

ECTS Credits:

3,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 1st period.

Learning outcomes:

Introduce students to importance of PID control for industrial automation and process control design. Learning outcomes: The student can use the MATLAB software to control design and analysis. The student can autonomously: for a build models for linear dynamic delayed systems, design PID controllers for them, and assess the closed loop behaviour. Student can form PID controller for a typical unit processes.

Contents:

Basics of Matlab/Simulink. The process models and modelling. PID controller design and implementation of automation system. PID controller structures and restrictions. Analysis and tuning of PID controller. Industrial control circuits of basic connections.

Learning activities and teaching methods:

Lectures and exercises include guided computer simulations.

Recommended or required reading:

Tervaskanto M. (2010). PID-säädön perusteet. Systems Engineering Laboratory, Series A. Report A32, 98 pp. Additional literature: Will be announced later.

Assessment methods and criteria:

The course concludes in a written exam or skill tests.

Person responsible:

University teacher Manne Tervaskanto

477505S: Fuzzy-neuromethods in Process Automation, 4 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Esko Juuso

Opintokohteen kielet: Finnish

Leikkaavuudet:

477525S Computational intelligence in automation 5.0 op

470438S Fuzzy Sets and Neural Networks in Process Automation 3.5 op

ECTS Credits:

4,0 cr

Language of instruction:

Finnish and English

Timing:

Implementation in 5th period.

Learning outcomes:

Objective: The objective of the course is to provide advanced understanding on the methodologies and applications of intelligent systems, especially in process automation.

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 genetic algorithms. 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 optimization. Moreover, the student is able to describe alternative solutions for dynamic models, hyper plane 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:

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.

Learning activities and teaching methods:

The course consists of lectures, several exercises, a case study, two seminars and a final report. The case study covers several topics applied in a chosen problem. Each seminar presentation concentrates on a single topic. The final grade is based on the combined points from exercises, case study, seminar and the final report. Final exam is an alternative for the final report. Reports and exams can be done also in English.

Recommended or required reading:

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

Person responsible:

University teacher Esko Juuso

790101P: GIS-basics and Cartography, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Geography

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay790101P GIS-basics and Cartography (OPEN UNI) 5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

3 or 5 ECTS

Language of instruction:

Partly in English. Exchange students are asked to contact prof. Rusanen before taking this course.

Timing:

2nd semester (spring semester)

Learning outcomes:

Basics of GIS science and theory of cartography

Contents:

Exercises (28 hours), notice: course will be arranged minimum of 3 student, book

Recommended or required reading:

Paul A Longley, Michael G Goodchild, David J. Maguire & David W. Rhind (2005). Geographic Information Systems and Science. 2nd edition. 516 p

Assessment methods and criteria:

Exam on exam day.

Grading:

1–5.

Person responsible:

Professor Rusanen

Other information:

(up-date 17.8.2011)

488115S: Geomechanics, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kauko Kujala

Opintokohteen kielet: Finnish

Leikkaavuudet:

480211A Advanced Course in Environmental Geotechnics 5.0 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 3rd-4th periods.

Learning outcomes:

The aim of the course is to provide the students an overview of mechanical behaviour of soil and rock materials in civil engineering applications.

Learning outcomes: Have a clear understanding of mechanical behaviour of soil structures in loading and environmental conditions. Understand design and dimensioning principles and can explain environmental aspects of soil behaviour.

Contents:

Origins and composition of soils, classification of soils, stresses and strains in soils, mechanical properties of soils, stability of slopes, bearing capacity of foundation, seepage analyses, freezing and thawing of soils, site investigations and in situ testing.

Learning activities and teaching methods:

Lectures, calculation and design exercises

Recommended optional programme components:

Basics in Geoenvironmental Engineering.

Recommended or required reading:

Handout and other materials delivered in lectures.

Assessment methods and criteria:

Examination and homeworks.

Person responsible:

Chief engineer Kauko Kujala

Other information:

Lectures are given every year.

477706S: Geophysical Investigation Methods of Bedrock, 3 op

Voimassaolo: - 31.07.2012

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kaikkonen, Pertti Johannes

Opintokohteen kielet: English

ECTS Credits:

3,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 4th period.

Learning outcomes:

After completing the course the student describe the basic geophysical methods in studying rock and soil. The student can explain the theoretical basics and the measuring techniques of the methods and is able to apply the methods in various important economical and civil tasks, e.g., in ore exploration.

Contents:

Basics of petro physical properties. Gravity methods, magnetic methods, resistivity methods, IP method, electromagnetic methods, radiometric methods and seismic methods: the physical principles, devices and the most important ways of using them in practice, aero geophysical methods, borehole measurements.

Learning activities and teaching methods:

Lectures

Recommended optional programme components:

Previous Master level courses in the study programme of Process Engineering, study orientation Mine Engineering, or respective information.

Recommended or required reading:

Assessment methods and criteria:

Examination

Person responsible:

Ph.D. Pertti Kaikkonen

488404A: Global Change, 5 op

Voimassaolo: 01.01.2009 - 31.07.2013

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ali Torabi Haghighi

Opintokohteen kielet: English

ECTS Credits:

5,0 cr

Language of instruction:

English

Timing:

Implementation in 1st-2nd periods.

Learning outcomes:

To introduce and describe the basic concepts in global change.

Learning outcomes: Students are able to describe the concept of global change, and to critically evaluate information available on global change.

Contents:

The basic concepts in global change: Overview of global change past, present and future perspectives; Method and tools for assessment, scenarios of future change; Overview of some climate change evidences such as global warming, sea level rising, melting glaciers, greenhouse gases, acid raining, ozone hole and so on; Evaluating the global change reasons (natural and human reasons); Evaluating the global change effect on water resource, health, aquatic ecosystems and their goods and services; Global change adaptation in context of sustainable development.

Learning activities and teaching methods:

Classroom discussions, student group work, extra literature survey , two reports, two presentations; learning diary. . Assessment is based on the performance of the different assignments listed before, grades 1-5.

Recommended or required reading:

Sources of material provided during the course.

Person responsible:

University teacher Ali Torabi Haghighi

488108S: Groundwater Engineering, 5 op

Voimassaolo: - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Rossi, Björn Klöve

Opintokohteen kielet: English

Leikkaavuudet:

480122A Groundwater Technology 5.0 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 1st-2nd periods.

Learning outcomes:

To acquire knowledge on water retention and flow in soils, hydraulics of ground water systems, ground water quality, ground water use and modelling.

Learning outcomes: Students learn to define hydraulic characteristics of soil and aquifers. Student is able to estimate key factors influencing on discharge and water quality of groundwater and to use general methods to calculate groundwater flow. The student is able to plan and manage, and protect groundwater resources in a sustainable way.

Contents:

Soil and ground water, water balance, hydraulic properties of soils, formation of ground water, flow equations and solutions, pumping tests and methods, ground water quality and modelling.

Learning activities and teaching methods:

Lectures, calculus assignments, a modelling tasks (GMS-MODFLOW).

Recommended optional programme components:

Hydrological Processes.

Recommended or required reading:

Lecture notes, Physical and Chemical Hydrogeology (Domenico PA, Schwartz FW, 2nd edition, 1998, ISBN 0-471-59762-7). Maanalaiset vedet - pohjavesigeologian 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:

Examination and report about modelling task are graded in the scale 1-5.

Person responsible:

Professor Björn Klöve

555325S: Human Resources Management, 3 op

Voimassaolo: - 31.07.2012

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Kess, Pekka Antero

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish

Learning outcomes:

Learning outcomes: After completing the course student knows the key concepts of human resource management and can explain these. The student can describe the structures of human resource organizations and can explain the meaning of management in the performance of human resource management. The student can analyse the human resources activities in a company and can produce improvement proposals based on the analysis. After the course the student can take part in the human resources management development in the role of an expert.

Contents:

People Capability Maturity Model

Target group:

Main target groups are the Students of Industrial Engineering and Management as well as those students in the departments of Mechanical Engineering and Process and Environmental Engineering who have the orientation to Industrial Engineering and Management. Other engineering students are accepted.

Recommended or required reading:

Curtis B, Hefley H & Miller S. (2002) The People Capability Maturity Model. Guidelines for Improving the Workforce. SEI Series. Management of Human Resources. Carnegie Mellon. Software Engineering Institute. Pearson Education, Lecture notes, Other material will be informed during the lectures.

Assessment methods and criteria:

Course is completed and assessed by team work report and its presentation in the closing seminar .

488203S: Industrial Ecology, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eva Pongracz

Opintokohteen kielet: English

Leikkaavuudet:

ay488203S Industrial Ecology and Recycling 5.0 op

480370S Industrial Ecology and Recycling 5.0 op

ECTS Credits:

5,0 cr

Language of instruction:

English

Timing:

Implementation in 2nd period.

Learning outcomes:

To familiarize the student with the major concepts of industrial ecology and clarify the role of technology towards sustainable development.

Learning outcomes: 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, decarbonization. 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.

Learning activities and teaching methods:

Lectures. Exercise work. Examination.

Recommended or required reading:

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

Person responsible:

D.Sc (Tech) Eva Pongrácz

477207S: Industrial Water and Wastewater Technologies, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

5 cr

Language of instruction:

Finnish

Timing:

Period 4.

Learning outcomes:

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

Contents:

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

Learning activities and teaching methods:

Lectures and small group exercises.

Recommended or required reading:

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

Assessment methods and criteria:

Exams and other evaluation methods. Occurring every other year.

Person responsible:

Professor Juha Tanskanen

488406A: Introduction to Environmental Science, 5 op

Voimassaolo: 01.01.2009 - 31.07.2012

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

5,0 cr

Language of instruction:

English

Timing:

Implementation in 4th period.

Learning outcomes:

The aim of the course is to familiarize the student with the principles of environmental science.

Learning outcomes: The student is able to define the basic concepts of environmental ecology. He/she has

knowledge about the state of environment and is able to explain the essential environmental problems and the main effects of pollution. In addition, the student knows some solutions to the environmental problems and is aware about ethical thinking in environmental engineering.

Contents:

Principles of environmental ecology. Roots of environmental problems. Global air pollution: ozone depletion, acid deposition, global warming and climate change. Water pollution, eutrophication, overexploitation of ground and surface water. Main effects of pollution and other stresses. Non-renewable and renewable energy. Energy conservation and efficiency. Hazardous and solid waste problem. Principles of toxicology and risk assessment. Environmental ethics.

Learning activities and teaching methods:

Self-study (book reading) and e-learning tasks in the Optima virtual learning environment, and exam. Please note that this course is arranged together with the course 488201A Environmental Ecology.

Recommended or required reading:

Self-study (book reading) and e-learning tasks in the Optima virtual learning environment, and exam. Please note that this course is arranged together with the course 488201A Environmental Ecology.

Person responsible:

Professor Riitta Keiski, Assistant Virpi Väisänen

783638S: Introduction to Fiber Chemistry of Polysaccharides, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Chemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Hormi Osmo

Opintokohteen kielet: Finnish

ECTS Credits:

3 credits

Language of instruction:

Finnish/English on demand.

Timing:

4th or 5th spring. The course is lectured every other year, next time during the autumn 2011.

Learning outcomes:

After passing the course the student can classify the most important chemicals used in papermaking.

Contents:

The fibre and its behaviour during papermaking, dry strength, wet strength, colloidal stability, retention and dewatering, water penetration and sizing, fillers and pigments, dyes, foam control, slime control.

Learning activities and teaching methods:

24 hours of lectures

Target group:

Chemistry, optional

Recommended optional programme components:

Introduction to Polymer Chemistry (780326A)

Recommended or required reading:

Eklund, D. ja Lindström, T.: Paper Chemistry, An Introduction, DT Paper Science Publication, Grankulla, 1991.

Assessment methods and criteria:

Final examination

Grading:

1-5/fail

Person responsible:

Prof. Osmo Hormi

465071A: Introduction to Materials Science, 3,5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leinonen, Jouko Iivari

Opintokohteen kielet: Finnish

Language of instruction:

Finnish; Laboratory exercises also in English

Learning outcomes:

The student will know the fundamental principles of materials science and the most important physical phenomena occurring in solid state of metallic structures.

Learning outcomes: After the course, the student is able to explain the fundamental characteristics of crystalline structure and special features attached. He/she is able to judge the effects of plastic deformation on metal structure and mechanical properties. In addition, he/she is able to present recovery and recrystallization of cold deformed metal and their significance in practice. Based on a phase diagram, the student is capable of estimating the microstructure of a metal alloy after solidification and phase transformations appearing in a solid state. He/she is also able to explain behavior of metal under pressure in cases of different type stresses and at different temperatures.

Contents:

Crystalline structure of metals; Plastic deformation, recovery and recrystallization; Phase diagrams; Phase transformations; Behavior of metal under pressure

Learning activities and teaching methods:

Lectures will be held during period 4, and the three laboratory exercises in small groups will be during periods 5 and 6. The final grade is based on the points from the final exam or small exams. The laboratory exercises will be graded as pass/fail. The course is recommended to be completed during the third study year.

Recommended or required reading:

Lecture booklet (in Finnish); Exercise materials

Additional material: Lindroos, V, Sulonen, M., Veistinen, M.: Uudistettu Miekko-ojan metallioppi. Otava: Helsinki, 1986.

771108P: Introduction to Ore Geology, 2 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Geosciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Gehör

Opintokohteen kielet: Finnish

ECTS Credits:

2 credits

Language of instruction:

finnish

Timing:

1st spring

Learning outcomes:

Students will a general view on the raw materials, their environmental impacts and exploration.

Contents:

Aspects of mineral economy, environmental impacts of raw material production and use, classification of ores and ore-forming processes, examples of ore types of abundant and scarce elements, methods of ore exploration, mining legislation.

Learning activities and teaching methods:

14 h lectures

Target group:

all geology students

Recommended or required reading:

Craig, J.R., Vaughan, D.J. & Skinner, B.J.: Resources of the Earth - Origin, Use, and Environmental Impact. Prentice Hall, 1996, 472 p.

Assessment methods and criteria:

written examination

Grading:

1-5/fail

Person responsible:

E. Hanski

488113S: Introduction to Surface Water Quality Modelling, 5 op**Voimassaolo:** - 31.07.2017**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Process and Environmental Engineering**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Anna-Kaisa Ronkanen**Opintokohteen kielet:** English**Leikkaavuudet:**

480210S Environmental Impacts of Industrial Effluents 5.0 op

ECTS Credits:

5,0 cr

Language of instruction:

English

Timing:

Implementation in 2nd-3rd periods.

Learning outcomes:

To assess the fate of detrimental elements in rivers and lakes using mathematical modeling.

Learning outcomes: Students can understand transport processes of harmful substances in surface waters and they know general modelling and calculations methods in the field.

Contents:

Introduction to modelling in water resources planning, environmental hydraulics, open channel flow, lake hydraulics, processes and water quality, dimensional analysis, hydraulic experiments, transport of conservative and reactive solutes in rivers. Modeling with ordinary differential equations, fully mixed systems, analytical and numerical methods for surface water modeling. Parameter estimation and uncertainty. Tracer tests and measurements systems.

Learning activities and teaching methods:

Lectures, exercises and modeling with Matlab.

Recommended optional programme components:

Hydrological Processes and basic university level knowledge of mathematics and physics.

Recommended or required reading:

Surface Water Quality Modelling (Chapra S, 1996, ISBN 0-0701-1-364-5). Fluvial Hydraulics: Flow and Transport Processes in Channels of Simple Geometry. (Walter HG, 1998, ISBN 0-0471-97714-4). Environmental Hydraulics of Open Channel Flows (Chanson H, 2004, ISBN 0-7506-6165-8). Handout and other materials delivered in lectures.

Assessment methods and criteria:

Report about exercises (grade 1-5), examination.

Person responsible:

University lecturer Anna-Kaisa Ronkanen

Other information:

Lectures are given every second years (even autumn periods).

488410A: Introduction to Sustainable Energy, 10 op**Voimassaolo:** 01.01.2010 - 31.07.2013**Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Process and Environmental Engineering**Arvostelu:** 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

2010 5,0 cr, 2011- 10,0 cr

Language of instruction:

English

Timing:

Implementation in 5th period.

Learning outcomes:

To give an introduction to the most common sustainable energy sources, production forms and distribution methods, and discuss the environmental opportunities, benefits and consequences of utilizing such energy.

Learning outcomes: The student will understand the basic physical principles of operation, capacity, growth rates and limitations of the main sources of renewable energy. They will also understand basic energy market operations and how infrastructure and political decisions affect the marketplace.

Contents:

This subject contains five parts. Each of these modules is described in detail below.

Learning activities and teaching methods:

Lectures and compulsory exercise done in small groups. Project work. Examination.

Recommended or required reading:

Godfrey Boyle: Renewable Energy, 2nd Edition, Oxford University Press in association with the Open University.

John Pitchel: Waste Management Practices. Municipal, hazardous and Industrial. Taylor and Francis Informa.

Additional literature: Kanti L. Shah: Basics of Solid and Hazardous Waste Management technology. Prentice Hall.

International Energy Agency: Energy Sector Methane Recovery and Use. The Importance of Policy.

Person responsible:

Professor Bjørn R. Sørensen, Narvik University College

488401A: Introduction to the Environmental and Socio-economical Issues of the Barents Region, 2 op

Voimassaolo: 01.01.2009 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kirsi *Marita Puikkonen

Opintokohteen kielet: English

ECTS Credits:

2,0 cr

Language of instruction:

English

Timing:

Implementation in 1st-2nd periods.

Learning outcomes:

This course provides an introduction to the Barents region, including its history and culture, and clarifies the main environmental and socio-economic incentives to the need of the Barents Environmental Engineering programme.

Learning outcomes: Students will understand the main environmental and socio-economic issues of the Barents region.

Contents:

History of the international cooperation between the areas along the coast of the Barents Sea, introduction to the environmental profile of the region, industry and infrastructure, people and cultures; Presentation of the Barents Cross-Border University project, the universities participating the Barents Environmental Engineering Programme and orientations in the programme; Showcasing the main focus areas of research and education in the BEE universities.

Recommended or required reading:

Material provided during the course.

Person responsible:

BEE Student advisor Marita Puikkonen, M.Sc. (Tech) Hanna Myllykoski

477112S: Laboratory Exercise of Pulp and Paper Technology, 3 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Ämmälä

Opintokohteen kielet: Finnish

Leikkaavuudet:

470113S Pulp and Paper Technology, laboratory exercises 3.5 op

ECTS Credits:

3,0 credits

Language of instruction:

Finnish

Timing:

Implementation during period 1-6.

Learning outcomes:

Objective: to give an understanding of the effects of pulp refining on the development of papermaking properties.

Learning outcomes: Upon completion of the course, a student can test papermaking potential of pulp, and analyze and report measurement data

Contents:

Basic pulp and paper testing methods.

Learning activities and teaching methods:

Lab exercises.

Recommended optional programme components:

Participation in the course is possible only those students having a major in the Advanced Special Module of Pulp and Paper Technology.

Assessment methods and criteria:

Reporting of the results of lab work.

Person responsible:

Postdoctoral Research Fellow Ari Ämmälä

488118S: Laboratory Exercises and Field Measurements in Environmental Engineering, 10 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ali Torabi Haghighi

Opintokohteen kielet: English

ECTS Credits:

10 cr

Language of instruction:

Finnish and English

Timing:

Implementation in 1st-6th periods.

Learning outcomes:

To familiarise the student with laboratory and field measurement techniques in environmental engineering, and to improve student's comprehension to apply techniques and methods in practice.

Learning outcomes: The student can determine physical properties of soil understand the basic of fluid flow and hydraulics in practices and know how to design essential treatment operation in the field of water treatment. The student also learns to observe and measure phenomena and report on observations in a systematic manner.

Contents:

Physical properties of soil, basic phenomena in hydraulics (pipe flow, water discharge from a tank, open channel flow), essential operation in water treatment (sizing of aerator, control of pH, settling processes, Jar-test), transport processes of harmful substances. Quality and safety of field measurements in environmental engineering. Planning of sampling and handling the results with statistical methods. Soil and water sampling with different sampling methods. Follow-up measurements.

Learning activities and teaching methods:

Laboratory and field exercises.

Recommended or required reading:

Announced during the course.

Assessment methods and criteria:

Report results from laboratory and field exercises.

Person responsible:

A. T. Haghighi

Other information:

The course is only for students of water engineering.

464051A: Machine Drawing, 3,5 op

Voimassaolo: 01.08.2005 - 31.07.2021

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tapio Korpela

Opintokohteen kielet: Finnish

Leikkaavuudet:

464101A Machine drawing and CAD 5.0 op

Learning outcomes:

The aim of the course is to teach students to read and to draw machine drawings and to carry out standard specifications of description methods, legends and dimensioning.

Learning outcomes: After the course, the student is able to read machine drawings and he/she is able to draw them according to the standardized projection methods, legends and dimensioning.

Contents:

Purpose of machine drawing; Description and dimensioning of parts; Design and viewpoints of manufacturing; Specifications of welds and surface roughness and tolerances on drawings; Principles of diagrammatic drawings

Learning activities and teaching methods:

Lectures and problem solving exercises are held in the first and the second period. A personal exercise work is done during the third period. After the passed problem solving exercises and the personal exercise work a student is allowed to take part in an exam. Half of the final grade is based on the grade of the exercises and another half of the final grade is based on the grade of the exam.

Recommended or required reading:

Pere, A.: Koneenpiirustus

555361A: Machine Safety and Usability, 3,5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Väyrynen

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish.

Learning outcomes:

The course makes students familiar with the design of machinery, product or plant, which is characterized by proper usability and safety features. The course also develops the abilities to analyse, enhance and maintain a high level of safety and productivity by means of modern management and leadership.

Learning outcomes: After the course the student is able to choose the design and management methods that enable the organization to remove risks especially on machines and products, and secondly to increase the usability of machines and products and user-friendliness of the work stations. He is able to apply the course's contribution to the company fulfilling the EU's obligations under the newest regulation. The student knows the responsibilities for risk control and opportunities of high quality well-being and usability in design and management.

Contents:

The new EU and global standardization and harmonization of machine safety. Safety analysis. Work accidents related to machines. Ergonomics and usability in design.

Recommended or required reading:

Väyrynen, S, Nevala, N & Päivinen, M (2004); *Ergonomia ja käytettävyys suunnittelussa*. Teknologiateollisuus. 336 s ..; Laitinen, H, Vuorinen, M & Simola, A: *Työturvallisuuden ja -terveyden johtaminen*. Tietosanoma, 2009. 494 s.; *Valtioneuvoston asetus koneiden turvallisuudesta* (12.6.2008/400); *Valtioneuvoston asetus työvälineiden turvallisesta käytöstä ja tarkastamisesta* (12.6.2008/403) ; *Riskin arviointi*, Työsuojeluoppaita ja -ohjeita 14. Työsuojeluhallinto 2009.

Additional literature: Dul, J & Weerdmeester, B (2008): *Ergonomics for beginners: a quick reference guide*. 3rd ed. CRC Press; SFS-koneturvallisuusstandardit (EN-ISO, www.sfs.fi); *Turvallisuusjohtaminen*, Työsuojeluoppaita ja -ohjeita 35. Työsuojeluhallinto 2008.; www.vtt.fi/proj/riskianalyysit/

464087A: Maintenance Technology, 5 op

Voimassaolo: - 31.07.2021

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Lahdelma, Sulo Olavi

Opintokohteen kielet: Finnish

Leikkaavuudet:

462103A	Introduction to Maintenance	5.0 op
462107A	Maintenance of machines	5.0 op

Language of instruction:

Finnish

Learning outcomes:

The objective of the course is to provide an overview of targets and lines of action in the maintenance of industrial plants. In addition, the student is introduced to machine diagnostics and reliability technology.

Learning outcomes: After the course, the student is able to talk about the significance and targets of the maintenance of industrial plants and use the most important terms or concepts related to maintenance and reliability. He/she will recognize the elements affecting the life-cycle costs of products or the overall effectiveness of production lines. The student also knows how to use different reliability technology models and can introduce the most common maintenance strategies and organizing methods. After the course, the student is capable of explaining the significance of machine diagnostics in maintenance and indicating the main diagnosis tools. He/she is able to identify the most typical machine faults by means of overall level and time domain measurements and frequency spectra. The student is also able to evaluate machine vibration severity and carry out single and two-plane balancing. In addition, he/she knows how to take into consideration the requirements that maintenance places on the machine design.

Contents:

The general part of the course discusses the basics of reliability technology, maintenance management and economics, and the issue of taking maintenance into consideration in machine design. The content of the diagnostics section of the course is: 1. Overall level measurements and evaluation of vibration severity; 2. Time and frequency domain analysis; 3. Dynamic balancing.

Learning activities and teaching methods:

The course consists of lectures and exercises arranged during the 6th period. The grade of the course is based on a final examination. The student must pass the exercises before taking the examination.

Recommended or required reading:

Lahdelma, S., Lecture notes: Diagnosis of machine condition, 2008. (In Finnish); Järviö, J., et al., Kunnossapito. Helsinki, KP-Media Oy / Kunnossapitoyhdistys ry 2007. (In Finnish); Lectures and other material will be distributed during the course. English course material is also available.

Supplementary readings: Järviö, J., Luotettavuuskeskeinen kunnossapito. Rajamäki, KP-Tieto Oy / Kunnossapitoyhdistys ry 2000. (In Finnish); Käynnissäpidon johtaminen ja talous. Loviisa, SCEMM 1996. Available also in English: Keep It Running - Industrial Asset Management. Loviisa, SCEMM 1998.

465061A: Materials Engineering I, 5 op

Voimassaolo: 01.01.2006 - 31.07.2021

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leinonen, Jouko Iivari

Opintokohteen kielet: Finnish

Leikkaavuudet:

465101A Introduction to materials for mechanical engineering 5.0 op

Language of instruction:

Finnish; Laboratory exercises also in English

Learning outcomes:

The objective of the course is to familiarize the student with basic matters concerning properties of metallic and non-metallic structural materials, the area within which the materials are in use, and the principles of materials selection.

Learning outcomes: After the course, the student is able to explain the measurement of mechanical properties by using different material testing methods and draw conclusions from the measurement results. He/she is able to separate corrosion properties of different metals can apply different corrosion protection methods. The student is also able to classify steels, cast irons, non-iron metals, plastics and structural ceramics. He/she can explain phase diagrams of metal alloys. The student masters structural materials and their selection so that he/she is able to select the most proper structural material for a product or component.

Contents:

Common structural materials in mechanical engineering; Materials selection taking into account different demands

Learning activities and teaching methods:

The course is made up of lectures, a materials selection exercise in small group during periods 1 and 2 and three laboratory exercises in small groups during periods 1 - 3. The final grade is based on the points from the final exam or small exams (weight 3) and from the materials selection exercise (weight 1). The laboratory exercises will be graded as pass/fail. The course is recommended to be completed during the second study year.

Recommended or required reading:

Lecture booklet (in Finnish); Exercise materials

477105S: Mechanical Pulping, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Ämmälä

Opintokohteen kielet: Finnish

Leikkaavuudet:

477124S Mechanical processing of biomasses 5.0 op

470310S Mechanical Pulping 2.5 op

ECTS Credits:

3,0 credits

Language of instruction:

Finnish

Timing:

Implementation in period 2 every other year.

Learning outcomes:**Objective:** To deepen knowledge about mechanical and chemimechanical pulping.**Learning outcomes:** 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 quality of the end product. In addition, the student can compare fibre properties of different mechanical and chemi-mechanical pulps and can explain their effects on the quality of the end product.**Contents:**

Mechanical and chemimechanical pulping, unit operations in those processes.

Learning activities and teaching methods:

Lectures.

Recommended optional programme components:

Pulp and Paper Technology 477103A

Recommended or required reading:

Book series: Fapet Oy. Papermaking Science and Technology, book 5. Mechanical Pulping. 427 s.; Smook, G. A.: Handbook for Pulp and paper Technologists. Vancouver 1992, 419 s. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:

Exam. Literature exam possible for foreign students.

Person responsible:

Postdoctoral Research Fellow Ari Ämmälä

740149P: Metabolism I, 4 op**Opiskelumuoto:** Basic Studies**Laji:** Course**Vastuuyksikkö:** Department of Biochemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Tuomo Glumoff**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

ay740158P Basic biochemistry 3: Metabolis (OPEN UNI) 4.0 op

ay740154P Basic biochemistry 3: Metabolis (OPEN UNI) 3.0 op

740146P Metabolism I 6.0 op

ECTS Credits:

4 credits

Language of instruction:

Finnish

Timing:

spring

Learning outcomes:

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

Contents:

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

Learning activities and teaching methods:

The module is arranged into 30 h of lectures and problem-based exercises

Target group:

Minor subject students

Recommended optional programme components:

Biomolecules for Biochemists or Biomolecules for Bioscientists or Biomolecules

Grading:

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

Person responsible:

Tuomo Glumoff

Other information:

This module is the same as Metabolism I (740146P), except that it contains no laboratory component

740375A: Metabolism II, 4 op

Voimassaolo: - 31.07.2012

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Biochemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Tuomo Glumoff

Opintokohteen kielet: Finnish

Leikkaavuudet:

740367A Metabolism II 6.0 op

ECTS Credits:

4 credits

Language of instruction:

Finnish

Timing:

autumn

Learning outcomes:

Students should be able to outline in detail how cells use various small and large molecules, how cells synthesize and degrade metabolites for their needs, and how metabolic network is connected and integrated.

Contents:

Metabolism II completes the discussion of energy metabolism by combining it with metabolism of nitrogen-containing compounds and synthesis and degradation of different biomolecules, as well as extends the analysis of the central concepts and mechanisms of metabolism. It will be seen how the metabolic pathways that were examined separately will be connected to each other and regulated. Some chemical mechanisms of pathways as well as ways to supply precursors for the main stream pathways will be handled. Special aspects of metabolism, like tissue specificity and physiological states, will also be studied. Photosynthesis is studied as continuation to energy metabolism.

Learning activities and teaching methods:

The module (4 credits) is arranged into lectures, workshops and homework (total ca. 40 h).

Target group:

Minor subject students

Recommended optional programme components:

Metabolism I

Recommended or required reading:

Voet et al. Principles of Biochemistry (International Student Version), Wiley, ISBN-13 978-0470-23396-2

Grading:

1-5/fail

Person responsible:

Tuomo Glumoff

Other information:

This module is the same as Metabolism II (740367A), except that it contains no practical component

477725S: Mine Automation, 7,5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

7,5 cr

Learning outcomes:

The goal with the course is to learn about different aspects of automation in the mining and underground construction industry, and the latest development in the field.

The goal with the course is learn about different aspects of automation in the mining and underground construction industry, and the latest development in the field. From the course you will learn about:

- How to consider human factors in automation.
- How operational data from mining equipment can be used in the mining process.
- How to describe basic foundations for automation of mining equipments.
- Explaining how automation works in drilling and drill rig, underground loading and transportation systems, in tunnelling projects and in surface mining.

Contents:

Human factor related problem, data communication, modern computerised control systems, automated units in the drilling process, data formats and IREDES, mine process data, AGV technology, navigation, surface navigation and GNSS (satellite navigation), mine planning tools.

Learning activities and teaching methods:

Lectures and project assignments. Written exam.

Recommended or required reading:

Scientific papers and seminars.

477721S: Mineral Processing, 7,5 op

Voimassaolo: - 31.07.2011

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

7,5 cr

Language of instruction:

English

Timing:

Implementation in 1st-3rd periods.

Learning outcomes:

After completion of the course the student should be able to: Calculate technical-economical conditions for winning of mineral resources; describe and explain commonly occurring processes for mineral beneficiation; Analyse reasons for selection of processes based on raw material properties; Generalise the know-ledge of process conditions to suggest process selections for hypothetical raw materials.

Learning outcomes: The course objective is to provide a possibility to understand mineral processes for ores, industrial minerals, recycling products and mineral fuels (coal and peat).

After completion the student should be able to:

- Calculate technical-economical conditions for winning of mineral resources,
- Describe and explain commonly occurring processes for mineral beneficiation,
- Analyse reasons for selection of processes based on raw material properties,
- Generalise the knowledge of process conditions to suggest process selections for hypothetical raw materials.

Contents:

Processing of ores; Particle technology; Industrial minerals and fuels; Environmental issues; Recycling; Management and mineral economy.

Learning activities and teaching methods:

The teaching comprises lectures, assignments, computer laboratory class, lessons and field trips. Examinations.

Recommended optional programme components:

Rikastustekniikan perusmenetelmät.

Recommended or required reading:

Later information.

Person responsible:

Prof. B. Pålsson, Luleå University of Technology - LTU

772619S: Mineralogical instrumental analytics, 4 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Geosciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Gehör

Opintokohteen kielet: Finnish

ECTS Credits:

4 credits

Language of instruction:

finnsih

Timing:

4th or 5th year

Learning activities and teaching methods:

26 h lectures, 16 h exercises and a practice work

Recommended or required reading:

Class handouts and selected readings

Person responsible:

S. Gehör

477723S: Mining Economy and Risk Evaluation, 7,5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

7,5 cr

Language of instruction:

English

Timing:

Implementation in 2nd-3rd periods.

Learning outcomes:

After the course the student will be able to: describe the theoretical foundations for mining and mineral economics, explain the most important issues in feasibility studies of mining projects, technically and economically analyse a proposed project, describe the national and international regulatory framework of evaluating mineralizations, able to apply basic risk assessment and management tools to different mining problems.

The course goal is to give the students deep knowledge regarding the theoretical foundations for mining and mineral economics, and to identify and evaluate risks in mining projects.

You will be able to

- describe the theoretical foundations for mining and mineral economics
- explain the most important issues in feasibility studies of mining projects
- technically and economically analyse a proposed project

- describe the national and international regulatory framework of evaluating mineralizations
- able to apply basic risk assessment and management tools to different mining problems.

Contents:

Mining and mineral economics theory, evaluation of mineralizations. Risk analysis of mining projects: basic theory, risk identification, assessment and handling.

Learning activities and teaching methods:

Lectures and exercises, and project work. The students will submit a written report and make an oral presentation of the project work. The students will work in groups and with problems related to mining industry. Written exam.

Recommended optional programme components:

Basic knowledge of mathematics, physics, economics and natural resources, and geology.

Recommended or required reading:

Literature will be decided later.

Person responsible:

J. Svanberg, Luleå University of Technology - LTU

477707A: Mining Engineering, 5 op

Voimassaolo: - 31.12.2013

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Särkkä

Opintokohteen kielet: Finnish

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 6th period.

Learning outcomes:

The student will learn the basics of mining engineering.

Learning outcomes: After completing the course the student is able to explain the unit processes and dependencies between them in a mine. He/she is able to estimate factors having influence in mine profitability and can explain the different regulatory mechanisms in mining industry.

Contents:

Technical and economical fundamentals for design and operation of open pits and underground mines. Opening decision, mine development, mining methods, hoisting, ventilation, dewatering, mine closure; mine legislation work safety, environmental aspects; evaluation and economic control of mine projects.

Learning activities and teaching methods:

Lectures, mine visit.

Recommended optional programme components:

Previous Master level courses in the study programme of Process Engineering, study orientation Mine Engineering, or respective information

Recommended or required reading:

Lecture materials, and as additional literature: Hakapää A. & Lappalainen P. (eds.) 2009: Kaivos- ja louhintateknikka. Opetushallitus, Kaivannaisteollisuusyhdistys 2009. 388 p. ISBN 978-952-13-3488-7

Assessment methods and criteria:

Participation to the mine visit, final examination.

Person responsible:

Pekka Särkkä

477708S: Mining Project Feasibility Study, 4 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

4,0 cr

Language of instruction:

English

Timing:

Implementation in 3rd period in Autumn 2010

Learning outcomes:

After completion of the course the student should be able to understand the content of feasibility study, calculate economical conditions and profitability for mining project, describe and explain differences in feasibility studies of different project stages. The student also understands and is able to evaluate the quality of feasibility studies. This involves addressing the underlying technical principles, applying these to mineral projects and demonstrating how these influence the financial modelling. The student will be able to prepare an economical calculation for feasibility study of the mining project and calculate free cash flow to it.

Contents:

Role of different feasibility studies. Guidelines and criteria for resource and reserve classification. Sources of technical information for feasibility study industry-level information. Quality requirements of technical and economical information. Pre-production planning and optimisation of the rate of mining in relation to the size of the resource. Mining methods. Importance of dilution, waste rock ratio, recovery and net smelter return. Estimation of operating and capital costs.

Learning activities and teaching methods:

20 h of lectures and 3 x 3 h exercises.

Recommended optional programme components:

The course is intended especially for the students of Oulu Mining School and the Nordic Mining School.

Recommended or required reading:

A literature list will be delivered later.

Assessment methods and criteria:

Exercises and examination.

Grading:

1-5

Person responsible:

Professor Timo Lindborg

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

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Leiviskä, Kauko Johannes

Opintokohteen kielet: English

Leikkaavuudet:

480452S Bioprocess Modelling and Control 5.0 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 1st period.

Learning outcomes:

To familiarise the student with bioprocess (fermentation) modelling and control.

Learning outcomes : After the course, the student can model kinetics and dynamics of biotechnical 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. Modela: different modeling approaches with examples. Control

Learning activities and teaching methods:

The course is given within the period of five weeks. Opening lecture, individual work and home tests (one per week). Laboratory exercises include computational exercises and writing the report. Grade given is based on home test and exercise report; ratio is 4/1. Final examination is also possible. Then the accepted exercise corresponds to one test example.

Recommended optional programme components:

Course Process Control Engineering I recommended beforehand

Recommended or required reading:

Lecture material.

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.

Person responsible:

Professor Kauko Leiviskä, University Teacher Esko Juuso

488111S: Modelling in Geoenvironmental Engineering, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

485305S Modelling in Geoenvironmental Engineering 5.0 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 5th-6th periods.

Learning outcomes:

To provide the student with the use of models and computational programs used in design and dimensioning of geoenvironmental materials and geostructures.

Learning outcomes: After the course the student can apply the numerical calculation methods in design and dimensioning of earth and geoenvironmental structures. The student can evaluate the influence of boundary conditions and material parameters in calculation results.

Contents:

Contaminant transport. Design and dimensioning of waste containment systems, liner systems for landfills and surface impoundment, tailings and dams. Freezing and thawing of earth structures.

Learning activities and teaching methods:

Lectures, design and modelling assignments.

Recommended optional programme components:

Geomechanics

Recommended or required reading:

Lecture handout and other materials delivered in lectures.

Assessment methods and criteria:

To solve given assignments and to write reports about them.

Person responsible:

Chief engineer Kauko Kujala

Other information:

Lectures are given every year.

740373A: Molecular Biology I, 4 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Biochemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Kaija Autio, Pospiech, Helmut

Opintokohteen kielet: Finnish

Leikkaavuudet:

740361A Molecular Biology I 8.0 op

740318A Molecular Biology 4.0 op

ECTS Credits:

4 credits

Language of instruction:

Finnish

Timing:

autumn

Learning outcomes:

After this course students should understand modern molecular biology methods.

Contents:

The course covers gene structure, DNA replication, recombination, transcription and translation. The student will learn the most common recombinant DNA techniques, such as PCR, use of restriction endonucleases, preparation of recombinant plasmids and DNA sequencing.

Learning activities and teaching methods:

22 h lectures, plus exercises

Target group:

Minor subject students

Recommended optional programme components:

Cellular biology, Biomolecules for Biochemists, Biochemical methodologies I

Recommended or required reading:

Kirjallisuus Strachan, Read: Human Molecular Genetics 3. Garland Science, 2004. Mathews, van Holde, Ahern: Biochemistry (3rd edition). Addison Wesley Longman, Inc., latest edition

Grading:

1-5/fail. Attendance on lectures 20%, homeworks 40%, final exam 40 %

Person responsible:

Helmut Pospiech

Other information:

This course is the same as Molecular biology I (740361A) but without practical part

477308S: Multicomponent Mass Transfer, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ainassaari, Kaisu Maritta, Muurinen, Esa Ilmari

Opintokohteen kielet: Finnish

Leikkaavuudet:

470302S Multicomponent Separation 5.0 op

ECTS Credits:

5 cr

Language of instruction:

Finnish

Timing:

Implementation in 5th period.

Learning outcomes:

To make the student familiar with mathematical modeling of mass transfer in multicomponent systems and separation processes based on diffusion.

Learning outcomes: Upon completing the required coursework the student is able to formulate the 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. The student 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. He/she is also able 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 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.

Learning activities and teaching methods:

Lectures including exercises.

Recommended optional programme components:

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

Recommended or required reading:

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

Assessment methods and criteria:

Examination and a simulation exercise.

Person responsible:

Laboratory manager Esa Muurinen

488121S: Municipality Geotechnics, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kauko Kujala

Opintokohteen kielet: Finnish

ECTS Credits:

5 cr

Language of instruction:

Finnish

Timing:

periods 5-6

Learning outcomes:

The aim of the course is to provide the students an overview of geotechnical design and dimensioning of municipal earth structures.

Learning outcomes: The student knows how calculate stability and settlement of municipal earth structures, design the structures against frost depth and frost heave and evaluate the needs for soil improvement. The student can also design geotechnical structures of industrial and domestic landfills and evaluate the needs for remediation of contaminated soils.

Contents:

Norms and instructions, basis of geotechnical design, earth and road structures, properties of soil material and industrial by-products, slope stability, settlement calculations, soil improvement, excavations, frost depth and frost heave calculation, thaw settlement, dams and tailings, landfill bottom

Learning activities and teaching methods:

Lectures and exercises

Recommended optional programme components:

Geomechanics

Recommended or required reading:

Handout and other materials delivered in lectures

Person responsible:

Chief Engineer K. Kujala

477306S: Non-ideal Reactors, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

Leikkaavuudet:

470222A Reactor Analysis and Design II 5.0 op

ECTS Credits:

5 cr

Language of instruction:

English

Timing:

Implementation in 3rd period.

Learning outcomes:

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

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

Contents:

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

Learning activities and teaching methods:

Lectures including exercises.

Recommended optional programme components:

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

Recommended or required reading:

Nauman, E.B.: Chemical Reactor Design. New York, John Wiley & Sons. 1987; Winterbottom, J.M. & King, M.B. (Editors) Reactor Design for Chemical Engineers. Padstow 1999, T.J. International Ltd. 442 s.

Additional literature : Gianetto, A. & Silveston, P.L.: Multiphase Chemical Reactors: Theory, Design, Scale-up. Hemisphere, Washington, D. 1986; Froment, G. & Bischoff, K.B.: Chemical Reactor Analysis and Design. New York, John Wiley & Sons. 1990; Hessel, V., Hardt, S. & Löwe, H.: Chemical Micro Process Engineering.

Weinheim 2004, Wiley-VHC Verlag GmbH & Co. 674 p, Salmi, T., Mikkola, J.-P. & Wärnä, J. Chemical reaction engineering and reactor technology. Boca Raton 2011, CRC Press, 615 p.

Person responsible:

Professor Riitta Keiski

477724S: Numerical Mine Modelling, 5 op

Voimassaolo: - 31.07.2013

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

477713S Automation in Mineral Processing 5.0 op

ECTS Credits:

3,0 cr

Language of instruction:

English

Timing:

Implementation in 6th period during a week intensive course.

Learning outcomes:

The course will make the student familiar with design software, SURPACK, in mine modelling.

Learning outcomes:

The goal with the course is learn about management of investigation data, data analyses, visualization, geological and geotechnical modelling, rock mechanical analyses, open pit and underground mine design.

Contents:

Management of investigation data, data analyses, visualization, geological and geotechnical modelling, rock mechanical analyses, open pit and underground mine design.

Learning activities and teaching methods:

Compulsory exercises and examination.

Recommended or required reading:

Lecture notes.

488123S: Open Channel Flow and Hydraulic Structures, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ali Torabi Haghighi

Opintokohteen kielet: English

488400A: Orientation to the BEE studies, 0 - 1 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kirsi *Marita Puikkonen

Opintokohteen kielet: English

464074S: Paper Machinery Construction, 7 op

Voimassaolo: - 31.07.2021

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Niskanen, Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

464106S Production machine design, Paper machinery 10.0 op

Learning outcomes:

The aim of this course is to provide students with good knowledge of applications of machine construction in the pulp and paper industry, especially in design and manufacturing of paper machines and maintenance duties serving pulp and paper industry, as well as export trade and research.

Learning outcomes: Upon completion of the course, the student can explain the importance of the pulp and paper industry to domestic economy, can describe the main stages of paper making processes, is able to analyze the affect of different paper machine designs on its production and product quality and knows design criteria of main paper machine components.

Contents:

Fundamentals of pulp and paper making processes, structures, functions and design criteria of paper machines and related workshop production; Detailed design criteria of paper machine parts, calenders, rolls as well as construction materials

Learning activities and teaching methods:

The course includes lectures and several excursions to domestic paper mills and machine shops. The course also includes a limited excursion to foreign destinations. Two mid-term exams or a final exam and a seminar work from given topic will be part of this course.

Recommended or required reading:

Copies of lecture material

477107S: Paper Manufacture, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Timo Jortama, Ari Ämmälä

Opintokohteen kielet: Finnish

Leikkaavuudet:

477126S Manufacturing of fibre products 5.0 op

470112S Paper Manufacture 2.5 op

ECTS Credits:

3,0 credits

Language of instruction:

Finnish

Timing:

Implementation in period 3 every other year.

Learning outcomes:

Objective: To deepen knowledge about paper manufacturing.

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

Contents:

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

Learning activities and teaching methods:

Lectures.

Recommended optional programme components:

Pulp and Paper Technology 477103A

Recommended or required reading:

Book series: Fapet Oy. Papermaking Science and Technology, books 8, 9, 10. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:

Exam. Literature exam possible for foreign students.

Person responsible:

Teacher Timo Jortama, Postdoctoral Research Fellow Ari Ämmälä

464085A: Patenting, 3,5 op

Voimassaolo: - 31.07.2021

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Niskanen, Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

464104A Product innovations 5.0 op
ay464085A Patenting (OPEN UNI) 3.5 op

Learning outcomes:

The purpose of this course is to provide students with the knowledge of principals and different ways to protect industrial property rights in Finland and internationally. The main emphasis is on patenting; how to protect valuable product design from imitation; and how to avoid infringement of competitors' industrial property rights. Learning outcomes: Upon completion of the course, the student can explain conditions for a patentable design and compare patenting to other ways of protecting industrial rights and is able to make an application for patent. The student also knows employer's and employee's rights in case of making an invention as an employee.

Contents:

Product protection models and their use in competition; Comprehension and legitimacy of the protection by patent; Applying for patent and making an application for a patent; Applying for a patent in a foreign country; Situations involving a conflict; Patent legislation

Learning activities and teaching methods:

The course includes lectures with several practical examples. The guided exercise is to make a domestic patent application. The final exam and an exercise where a group of students prepare a patent application will be part of the course. The final grade is the average of the exam and exercise.

Recommended or required reading:

Copies of lecture material

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

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

ECTS Credits:

10 cr

Language of instruction:

Finnish (English if necessary).

Timing:

Implementation in 1st-3rd periods.

Learning outcomes:

Objective: To familiarize with the essential phenomena of the metallurgical processes as well as to learn to use the models and methods developed for the investigation of these phenomena in the metallurgical research and development.

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

Contents:

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

Learning activities and teaching methods:

Group exercises and contact-education that supports these exercises.

Recommended optional programme components:

Knowledge and skills corresponding the knowledge and skills that are obtained from the Bachelor-level-studies in the programme of process or environmental engineering are required as prerequisites.

Recommended or required reading:

Material will be distributed during lectures and exercises.

Assessment methods and criteria:

Group-exercises.

Person responsible:

University teacher Eetu-Pekka Heikkinen.

465081S: Physical Metallurgy I, 7 op

Voimassaolo: - 31.12.2014

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

465110S Strength of metallic alloys 7.0 op

465064S Strength of metal alloys 7.0 op

Language of instruction:

Finnish

Learning outcomes:

The aim of the course is to introduce the factors and phenomena in metals and alloys under plastic straining affecting their plastic flow, strain hardening rate and strength properties. In particular, the role of the stacking fault energy on dislocation movement and resultant dislocation structures and plastic flow are considered.

Learning outcomes: Upon completing of the required coursework, the student is able to explain the strengthening mechanisms in metals and alloys. He/she can explain the influence of alloying on the stacking fault energy of an alloy and its influence on the characteristics of dislocations and their ability to move in a lattice. He/she is able to compare the strain-hardening rates of alloys and can explain the effect of grain size on static, fatigue and creep strengths. He/she also has skills to analyse simple transmission electron microscopy pictures, knows the main mechanisms in fatigue and creep deformations and is able to list the most important factors affecting the behaviour. The student is able to utilize deformation maps in creep analysis and is able to list the main terms affecting texture formation and analysis.

Contents:

Strengthening mechanisms: dislocation hardening, solid solution, precipitation, grain size refinement, multiphase structures; A brief introduction to the dislocation theory; Fatigue; Creep; Texture; Fracture process

Learning activities and teaching methods:

The course consists of 45 hours of lectures and a seminar during periods 2 and 3..

Recommended optional programme components:

465061A Materials Engineering I and 465075A Research Techniques for Materials

Recommended or required reading:

Lecture notes

R.W. Cahn and P. Haasen, Physical Metallurgy, 4 ed., North Holland, 2005. (electric version)

R.E. Smallman and R.J. Bishop, Modern Physical Metallurgy & Materials Engineering, 6th ed., Butterworth-Heinemann, Elsevier Science Ltd, 1999. (electric version 2002).

465082S: Physical Metallurgy II, 7 op

Voimassaolo: - 31.12.2014

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: David Porter

Opintokohteen kielet: Finnish

Leikkaavuudet:

465109S	Microstructural changes in metallic alloys	7.0 op
465063S-01	Microstructural changes in metallic alloys, examination	0.0 op
465063S-02	Microstructural changes in metallic alloys, exercises	0.0 op
465063S	Microstructural changes in metallic alloys	7.0 op

Language of instruction:

Finnish

Learning outcomes:

The aim of the course focuses on the combination and adaptation of contents of the material from previous science courses into practical and applicable knowledge with an advanced understanding on physical metallurgy. Learning outcomes: After the course, the student is capable to apply basic principles of thermodynamics and kinetics to phase transformations. He/she is able to estimate the effect of a phase diagram on the microstructure of a metal alloy. On the basis of diffusion theory, the student is able to explain solidification, recrystallization and precipitation of metal alloys, and additionally the phase transformation of steels during austenite dissociation (ferrite, pearlite, bainite, martensite). He/she is also able to explain phase structures and their mechanical properties in steels on the basis of TTT diagrams.

Contents:

Thermodynamics and kinetics of phase transformations in a solid state; Phase diagrams; Diffusion; Solidification; Recrystallization; Precipitation; Martensitic transformation; Pearlite and bainite reactions; TTT diagrams and their applications

Learning activities and teaching methods:

The course consists of lectures and seminars during periods 4 to 6. The final grade is based on the weighed combined points from the final exam or the small exams and the personal seminar work.

Recommended optional programme components:

Materials Engineering I, Introduction to Materials Science

Recommended or required reading:

Lecture booklet (in Finnish)

Additional material: Porter, D. & Easterling, K.: Phase Transformations in Metals, Van Nostrand Reinhold Company: New York, 1981; Honeycombe, R.W.: Steels - Microstructure and Properties.

477611S: Power Plant Automation, 2 op

Voimassaolo: 01.01.2010 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Laura Niva, Jenő Kovács

Opintokohteen kielet: Finnish

Leikkaavuudet:

477625S Power Plant Automation 5.0 op

ECTS Credits:

2,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 5th period.

Learning outcomes:

After participating in the course, the student has learned different types of thermal power plants, their sub-processes and their operation. In addition, the student has familiarized him/herself with power plant simulation, the automation system and the data collection system, which are used in the power plants.

Learning outcomes: The student has a full understanding of the role of the power plants in energy market and the importance of different energy sources. The student will understand the structure of different power plants, the main components and can explain their behaviour and operation. The role and manner of measurements will be clarified. Furthermore, the student will understand the main principles in modelling energy systems.

Contents:

Introduction to energy market and consumption. Description of different types of power plants and the main components and their operation. Fundamentals of industrial measurements, sensors, emissions and industrial actuators. Static and dynamic modelling of power plants.

Learning activities and teaching methods:

Lectures. The course will be lectured annually.

Recommended or required reading:

Joronen, T., Kovács J. & Majanne Y. (2007) Voimalaitosautomaatio. Suomen automaatioseura Oy. 276 pp.

Assessment methods and criteria:

Examination.

Person responsible:

Researcher Laura Lohiniva, Docent Jenő Kovács

477612S: Power Plant Control, 3 op

Voimassaolo: 01.01.2010 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jenő Kovács

Opintokohteen kielet: English

Leikkaavuudet:

477625S Power Plant Automation 5.0 op

ECTS Credits:

3,0 credits

Language of instruction:

English

Timing:

Implementation in 6th period annually.

Learning outcomes:

After participating in the course, the student has learned the difference between the operation of different boiler types and its relevance in control design. The students will have the knowledge on the control structures and the behaviour of the different loops. The current stage of control design and the potential future development area will be introduced.

Learning outcomes: The student will fully understand the static and dynamic behaviour of the power plants and the sub processes. The student will understand the role of control in power plant operation and can describe the main principles and structures of control systems. The student will be able to explain the behaviour of control of sub processes.

Contents:

Detailed description of different power plant types and their operation. Advances in power plants technology - once-through boilers. The control principles and the main control loops. Comparison of different control solutions. The interaction between different parts of the power plants. Coordinated control. Control of sub processes. Advanced control solutions.

Learning activities and teaching methods:

Lectures, exercises, simulation demonstrations, 20+10 hours. Examination. Requirement: completing the course of Power Plant Automation or equivalent knowledge.

Recommended or required reading:

Lecture handout and material will be provided at the beginning of the course.

Person responsible:

Doc. Jen# Kovács

477704A: Principles of Mineral Processing, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Mörsky

Opintokohteen kielet: Finnish

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 5th period.

Learning outcomes:

The student will learn about the principles and basic methods of beneficiation

Learning outcomes: After the course the student knows principles of beneficiation and beneficiation process. Additionally the student will acquire the skill to recognize essential variables in process and understand these consequences to beneficiation process.

Contents:

Grinding methods, separation methods, process control. Practical examples of mineral processing. Associating unit processes to optimal beneficiation process.

Learning activities and teaching methods:

Lectures, practical exercises, excursion to mills or research institutes.

Recommended optional programme components:

Bachelor level courses on fluid and particle engineering I recommended beforehand.

Recommended or required reading:

Lecture material.

Additional literature : Wills, B.A. & Napier-Munn, T.J. Will's Mineral Processing Technology, 7th edition, 2007, Elsevier, 444 s.

Assessment methods and criteria:

Final examination.

Person responsible:

M.Sc. (Tech) Pekka Mörsky

477108S: Printing Technology, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Ämmälä

Opintokohteen kielet: English

ECTS Credits:

2,0
credits

Language of instruction:

Finnish

Timing:

Implementation in period 3 every other year.

Learning outcomes:

Objective: To give basic knowledge about printing technology.

Learning outcomes: Upon completion of the course, a student should be able to identify those paper properties that affect printing of paper and can evaluate their importance in result of printing. The student can explain different printing methods and processes. In addition, the student identifies printing inks and can explain their most important properties.

Contents:

Mechanical and electronic (digital) printing, demands of the printing methods for the paper, printing ink and their properties.

Learning activities and teaching methods:

Lectures.

Recommended optional programme components:

Pulp and Paper Technology 477103A. Paper Manufacture 47717S.

Recommended or required reading:

Book series: Fapet Oy. Papermaking Science and Technology, book 13: Print media - principles, processes and quality. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:

Exam. Literature exam possible for foreign students.

Person responsible:

Postdoctoral Research Fellow Ari Ämmälä

477610S: Process Information Systems, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hiltunen, Jukka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

477623S Process Information Systems 10.0 op

477606S Fault Diagnosis and Process Performance Analysis 2.0 op

ECTS Credits:

5,0 credits

Language of instruction:

Finnish

Timing:

Period 6.

Learning outcomes:

To introduce the factory and entire company-wide information systems where automation systems are part of a larger entity. The student will have the ability to design information systems especially for the need of chemical engineering.

Learning outcomes: After completing the course the student can plan, evaluate and develop large automation and information systems.

Contents:

Purpose of information systems. Technologies used in wide information systems. Case study analyses.

Learning activities and teaching methods:

Seminar. The course is held every two years during the one-period.

Recommended optional programme components:

Courses Introduction to Automation Engineering and Process Automation Systems or equivalent information recommended beforehand.

Recommended or required reading:

Will be announced later.

Assessment methods and criteria:

Seminars and examination.

Person responsible:

Lecturer Jukka Hiltunen

477504S: Process Optimization, 4 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Pentti Jaako

Opintokohteen kielet: Finnish

Leikkaavuudet:

477524S	Process Optimization	5.0 op
477524S	Process Optimization	5.0 op
470434S	Process Optimization	5.0 op

ECTS Credits:

4,0 cr

Language of instruction:

Finnish, however, the majority of study materials are in English. If a student desires to study in English, he/she must contact the course teacher two weeks before the commencement of the course.

Timing:

Implementation in 4th period.

Learning outcomes:

Course covers basic concepts of optimization and their application in process engineering. Learning outcomes: Student can use and apply standard unconstrained and constrained optimization methods. Student can define and identify a simple optimization problem and solve it. Student is able to summarize the role of optimization in process engineering.

Contents:

Optimization of unconstrained functions, fitting models to data, linear programming, nonlinear programming with constraints, formulation of objective functions, process optimization examples. Matlab(R) and optimization.

Learning activities and teaching methods:

Contact study hours (40 h) given during a five week period: short lectures and study group work. Homework for 67 hours: process optimization problem solving, study diaries are used for knowledge integration.

Target group:

Students interested in optimization.

Recommended optional programme components:

None required but a basic course taken in numerical methods is advisable

Recommended or required reading:

Course and exercise book (in Finnish). Ray WH, Szekeley J: Process Optimization, John Wiley & Sons, New York 1973; Edgar TF, Himmelblau DM: Optimization of Chemical Processes. McGraw-Hill: New York, 1988. Reklaitis GV, Ravindran A, Ragsdell KM: Engineering Optimization – Methods and Applications. Wiley: New York, 1983.

Assessment methods and criteria:

Continuous assessment or terminal assessment. Continuous assessment recommended. English can be used in both.

Grading:

fail, 1-5 (5 best)

Person responsible:

University teacher Juha Jaako

Other information:

<http://ntsat oulu.fi/index.php?97>

477414S: Process Simulation in Extractive Metallurgy, 10 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Fabritius, Timo Matti Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

477422A Metallurgical Processes 6.0 op

ECTS Credits:

10 cr

Language of instruction:

Finnish (English if necessary).

Timing:

Implementation in 1st-3rd periods.

Learning outcomes:

Objective: To introduce the most important metal production processes and metallurgical unit operations used in Finland as well as to learn the modelling and simulation methods concerning these processes. Additionally, the roles of slags, reduction agents and refractory materials in the metallurgical processes are considered.

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

Contents:

Objective: To introduce the most important metal production processes and metallurgical unit operations used in Finland as well as to learn the modelling and simulation methods concerning these processes. Additionally, the roles of slags, reduction agents and refractory materials in the metallurgical processes are considered.

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

Learning activities and teaching methods:

Group exercises and contact-education that supports these exercises.

Recommended optional programme components:

Knowledge and skills corresponding the knowledge and skills that are obtained from the Bachelor-level-studies in the programme of process or environmental engineering are required as prerequisites.

Recommended or required reading:

Material will be distributed during lectures and exercises.

Assessment methods and criteria:

Group-exercises.

Person responsible:

Professor Timo Fabritius.

477309S: Process and Environmental Catalysis, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

470226S Catalytic Processes 5.0 op

ECTS Credits:

5 cr

Timing:Implementation in 2th period**Learning outcomes:**

Objective: Introducing the history, principles and economical and environmental meaning of catalysis, the design, selection and testing of catalysts and catalytic reactors and processes, and the most important industrial catalytic processes.

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

Contents:

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

Learning activities and teaching methods:

Lectures including design exercises.

Recommended optional programme components:

The courses 477011P Introduction to Process Engineering, 488011P Introduction to Environmental Engineering and 780109P Basic Principles in Chemistry are recommended beforehand

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.

Person responsible:

University researcher Mika Huuhtanen

465089S: Processing and Properties of Steels, 3,5 op

Voimassaolo: - 31.07.2021

Opiskelumuoto: Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Mechanical Engineering**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

465115S Processing and properties of steels 5.0 op

Language of instruction:

Finnish

Learning outcomes:

The course provides the students with an extensive introduction to manufacturing and properties of modern steels: the influence of the processing route, ladle metallurgy and thermo-mechanical treatments on microstructure and mechanical properties. Properties of various steel grades available are described and their developmental trends discussed. The influence of inclusions on steel properties are also dealt with.

Learning outcomes: Upon completing of the required coursework, the student is able to explain most important factors and stages affecting the quality of liquid steel. He/she can explain the metallurgical phenomena taking

place during thermo-mechanical processing of steels, and in particular, the techniques utilized for grain size refinement. The student is able to list and describe most important construction steel types, the main features of their properties and their development trends. The student can also explain the factors affecting the inclusion formation and techniques to control them. Furthermore, he/she can assess the influence of inclusions on steel properties.

Contents:

Processing and treatments of crude iron and steel; Continuous casting and thermo-mechanical processing of steels; Physical metallurgy behind the phenomena in the course of thermo-mechanical treatments; Modern steel grades and their development; Impurities and inclusions in steel and their influence on strength, fatigue, toughness, formability, weldability, etc.

Learning activities and teaching methods:

The course consists of lectures during the 2nd period and a laboratory exercise work. The assessment is given in the form of a final exam.

Note: The course is given in every other year.

Recommended or required reading:

Lecture notes

Tamura, T.: Thermomechanical Processing of High Strength Low Alloy Steels, Butterworths Co Ltd: London, 1988

Rautaruukin terästuotteet, Suunnittelijan opas, 2000

Rautaruukin teräkset ääriolosuhteissa, 2000.

555322S: Production Management, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Haapasalo, Harri Jouni Olavi

Opintokohteen kielet: English

Leikkaavuudet:

555333S Production Management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

English

Learning outcomes:

Aim: the aim of this course is to reach understanding of the role of the principles of production management at operational, tactical and strategic level. Learning outcomes: After finishing this course, the student will be able to analyze production processes and to define the cornerstones of managing different production modes. In addition the student will know how to analyze the bottlenecks in different production processes. By combining this and previous courses, the student will be able to define the most important development areas in production processes.

Contents:

Analysing and developing manufacturing environment. Controllability analysis. Change management.

Management and operation information methods. Mass customization.

Target group:

488202S: Production and Use of Energy, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

488208A Basics of production and use of energy 5.0 op

ECTS Credits:

3,0 cr

Language of instruction:

Finnish or English

Timing:

Implementation in 1st period.

Learning outcomes:

To provide the student with the basics of energy supply, use and equipment in Finnish communities and industrial plants. The student will know energy production, transfer, consumption and market structure in Finland. He/she will also know the distribution, adequacy and environmental issues of energy resources

Learning outcomes : The student is able to explain 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 is able to explain the environmental impacts of energy production and is able compare the environmental impacts of different ways of producing energy. 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.

Learning activities and teaching methods:

30 hours lectures

Recommended optional programme components:

The courses Introduction to Process Engineering and Introduction to Environmental Engineering recommended beforehand.

Recommended or required reading:

Lecture handout.

Person responsible:

University researcher Mika Huuhtanen

555341S: Productivity and Performance Management, 3 op**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Industrial Engineering and Management**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Haapasalo, Harri Jouni Olavi**Opintokohteen kielet:** English**Language of instruction:**

English

Learning outcomes:

The course familiarizes a student with the concepts of productivity and performance, with meters, and with the relationships between productivity and the different sectors of an enterprise. It also covers the evaluation of a firm's internal performance and the financial effects of developing productivity. Learning outcomes: After finishing the course, the student will be able to analyze the efficiency of activities in an organization, from both internal and external viewpoints. The internal analysis is based on Balanced Score Card or other equivalent performance measurement. External measurement of efficiency is based on analyzing productivity development and the factors affecting it.

Contents:

The concepts of productivity and performance and the levels to their examination. Productivity and its significance to an enterprise's processes and profitability. Measuring productivity and performance. The meters of productivity and operative steering tools. An enterprise's internal and external productivity. The analysis and the tools for analysis of productivity and the approaches for measuring productivity in industry.

555381S: Project Leadership, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Jokinen, Tauno Jaakko

Opintokohteen kielet: Finnish

Leikkaavuudet:

555391S Advanced Course in Project Management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish

Learning outcomes:

Upon completion the student should be able to:

Describe and apply essential theories of leadership

Learning activities and teaching methods:

Essey, intensiveday and learning report

Recommended or required reading:

Northouse PG (2001) Leadership: Theory and Practice; Second Edition. Sage Publications, Thousand Oaks.

Assessment methods and criteria:

The assessment is based on essay

555282A: Project Management, 4 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Jokinen, Tauno Jaakko, Jaakko Kujala

Opintokohteen kielet: Finnish

Leikkaavuudet:

555288A Project Management 5.0 op

555285A Project management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish

Contents:

Upon completion the student should be able to:

Apply the advanced concepts of project management.

Learning activities and teaching methods:

Lectures, exercises, learning report

Assessment methods and criteria:

Evaluation of learning report

555387S: Project Work in Quality Management, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Haapasalo, Harri Jouni Olavi

Opintokohteen kielet: Finnish

Leikkaavuudet:

555379S Research Project in Industrial Engineering and Management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish/English.

Learning outcomes:

Applying the methods of quality management in a company's activities and development. On the course the student can combine and apply earlier gained knowledge in the form of a wide study. The student familiarises with research work and reporting of the results.

Learning outcomes: Upon completion the student can analyse and develop the activities of a company using the methods of quality management.

Contents:

Subject and type of work changes by the case. Mostly the subjects come from the industry and relate to actual problems.

Learning activities and teaching methods:

The methods are agreed with the instructor of the work. Research plan, familiarizing with related literature, solving the problem and a literary report are required to pass. The work can be done individually or in a group.

Recommended optional programme components:

Bachelor in Industrial Engineering and Management or equivalent.

Recommended or required reading:

Changes by the case.

555388S: Project Work in Project Management, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

555379S Research Project in Industrial Engineering and Management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish/English.

Learning outcomes:

Applying the methods of project and project business management in a company's activities and development. On the course the student can combine and apply earlier gained knowledge in the form of a wide study. The student familiarises with research work and reporting of the results.

Learning outcomes : Upon completion the student can analyse and develop the activities of a project company.

Contents:

Subject and type of work changes by the case. Mostly the subjects come from the industry and relate to actual problems.

Learning activities and teaching methods:

The methods are agreed with the instructor of the work. Research plan, familiarizing with related literature, solving the problem and a literary report are required to pass. The work can be done individually or in a group.

Recommended optional programme components:

Bachelor in Industrial Engineering and Management or equivalent.

Recommended or required reading:

Changes by the case.

477109S: Pulp and Paper Laboratory Analyses, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Ämmälä, Tuomas Stoor

Opintokohteen kielet: Finnish

ECTS Credits:

2 credits

Language of instruction:

Finnish

Timing:

Implementation in period 1 every other year.

Learning outcomes:

Objective: To deepen knowledge about laboratory analyses used in pulp and paper industry.

Learning outcomes: The student is able to recognize the most important analytical methods used for analysing the pulp and fibre properties and knows what pulp properties they measure.

Contents:

Analysis methods for characterizing of pulp and fibres, and properties of paper and cartonboard.

Learning activities and teaching methods:

Lectures and lab demonstrations.

Recommended optional programme components:

Pulp and Paper Technology 477103A

Recommended or required reading:

Lecture materials and other materials that will be announced at the lectures. Book series: Fapet Oy. Papermaking Science and Technology. Pulp and Paper Testing, book 17.

Assessment methods and criteria:

Exam. Literature exam possible for foreign students.

Person responsible:

Postdoctoral Research Fellow Ari Ämmälä

477110S: Pulp and Paper Research Seminar, 3 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Ämmälä

Opintokohteen kielet: Finnish

Leikkaavuudet:

470309S Pulp and Paper Research Seminar 2.5 op

ECTS Credits:

3,0 credits

Language of instruction:

Finnish

Timing:

Implementation in period 5-6.

Learning outcomes:

Objective: To give the newest knowledge about research relating to pulp and paper technology.

Learning outcomes: Upon completion of the course, a student can summarise international scientific articles. In addition, a student can give a presentation and work as an opponent in a seminar.

Contents:

Topical research areas in pulp and paper industry.

Learning activities and teaching methods:

Literature review, seminar presentation, and acting as an opponent for another presentation.

Recommended optional programme components:

Pulp and Paper Technology 477103A

Recommended or required reading:

The newest books and articles.

Assessment methods and criteria:

Literature review, seminar presentation.

Person responsible:

Postdoctoral Research Fellow Ari Ämmälä

555323S: Purchase Management, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Kess, Pekka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

555330S Sourcing Management 5.0 op

Language of instruction:

Finnish

Learning outcomes:

Learning outcomes: After completing the course student knows the key concepts of purchase management and can explain these. The student can describe the structures of purchasing organizations and can explain the meaning of management in the performance of purchasing operations. The student can analyse the purchasing activities in a company and can produce improvement proposals based on the analysis. After the course the student can take part in the purchasing operations development in the role of an expert.

Contents:

The purpose of the purchasing operations. The principles of the purchase strategy and practices. Development of the purchasing function. Suppliers. Acquisitions. Terms of purchase.

Learning activities and teaching methods:

The course includes lectures and team work.

Target group:

Main target groups are the Students of Industrial Engineering and Management as well as those students in the departments of Mechanical Engineering and Process and Environmental Engineering who have the orientation to Industrial Engineering and Management. Other engineering students are accepted.

Recommended optional programme components:

555224A Tuotannon ja logistiikan menetelmät.

Recommended or required reading:

Lecture notes. Other material will be informed during the lectures.

Assessment methods and criteria:

Course is completed and assessed by team work report and its presentation in the closing seminar .

Grading:

fail ... 1...5/5

555380S: Quality Management, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Jaakko Kujala

Opintokohteen kielet: English

Leikkaavuudet:

555390S Process Analytics 5.0 op

Voidaan suorittaa useasti: Kyllä

Learning outcomes:

The course gives the student a broad conceptions of contents of total quality management and applying it in different environments.

Learning outcomes: Having completed the course, the student can analyze the central principles and contents of quality management and related management approaches. The student can apply the learned things and methods in different kinds of situations and industries.

Contents:

Total quality management and its basic assumptions, the methods of TQM in different environments, quality systems, quality award competitions, process management, performance measurement, organisational capability models.

Learning activities and teaching methods:

Lectures, lecture pre-exercises, group study and presentation. Grade is derived from group study, presentation and a final exam.

Recommended or required reading:

Lecture materials, course readings.

477106S: Recycled Fiber Processes, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Ämmälä

Opintokohteen kielet: Finnish

Leikkaavuudet:

477128S Circular Bioeconomy 5.0 op

477125S Recycling of bioproducts 5.0 op

470311S Recycled Fiber Processes 2.5 op

ECTS Credits:

3,0 credits

Language of instruction:

Finnish

Timing:

Implementation in period 2 every other year.

Learning outcomes:

Objective: To deepen knowledge about recycled fibre processes.

Learning outcomes: Upon completion of the course, a student should be able to identify the unit operations of recycled fibre processing and can explain their operational principles. The student can evaluate the importance of different unit operations, as well as the effect of raw material properties on the end product. The student is able to identify the most important chemicals used in recycled fibre processing and can explain their function in process.

Contents:

Raw materials, DIP and OCC processes and their unit operations.

Learning activities and teaching methods:

Lectures.

Recommended optional programme components:

Pulp and Paper Technology 477103A

Recommended or required reading:

Book series: Fapet Oy. Papermaking Science and Technology, book 7. Recycled Fiber and Deinking, 649 s.; Smook, G. A.: Handbook for Pulp and Paper Technologists. Vancouver 1992, 419 s. Lecture materials and other materials that will be announced at the lectures.

Assessment methods and criteria:

Exam. Literature exam possible for foreign students.

Person responsible:

Postdoctoral Research Fellow Ari Ämmälä

477321S: Research Ethics, 3 op

Voimassaolo: - 31.07.2019

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Keiski, Riitta Liisa

Opintokohteen kielet: English

Leikkaavuudet:

477312S Science and Professional Ethics 5.0 op

ECTS Credits:

3 cr

Language of instruction:

English

Timing:

Implementation in 4th period.

Learning outcomes:

After the course the student is capable of explaining the meaning of research ethics and good scientific practice including honesty, conscientiousness and precision in research work. The student is able to plan, carry out and report his/her research work, and is aware of the rights and duties of a researcher and their actions and respect towards other researchers. The student is able to recognise misconduct and fraud in scientific practices and has an awareness of how to handle misconduct.

Contents:

Ethically good research, Scientific community and ethical problems in research work. Professional ethics of a researcher and an engineer. Good scientific practices and handling of misconduct and fraud in science. Regulations and rules. Definitions, Characteristic features of science, Research results and responsible persons in scientific work, Ethics and research ethics, Professional ethics of a researcher, Research ethics in Finland and globally, Instructions for preventing, handling and examining misconduct and fraud in good scientific practices and scientific research, Good scientific practices and responsibility in performing research, Good practices in selecting the research problem, collecting the material, planning and performing the research, publishing, using and applying the results, Protection of a researcher under the law, Examples and statistics.

Learning activities and teaching methods:

Lectures and team work.

Recommended or required reading:

Clarkeburn, H. & Mustajoki, A. Tutkijan arkipäivän etiikkaa. Tampere 2007, Vastapaino. 319 p., Good scientific practice and procedures for handling misconduct and fraud in science. Helsinki 2002, TENK, National Advisory Board on Research Ethics., [Guidelines for the Prevention, Handling and Investigation of Misconduct and Fraud in Scientific Research](#). Helsinki 1998, TENK, National Advisory Board on Research Ethics., Martin, M.W. & Schinzinger, R. Ethics in Engineering, 4th Edition. New York, 2005, McGraw Hill Co. 339 p.

Additional literature: Hallamaa, J., Launis, V., Lötjönen, S. & Sorvali, I. Etiikkaa ihmistieteille. Tietolipas 211, Suomen Kirjallisuuden Seura, Helsinki 2006. 428 p., Pietilä, A.-M. & Länsimies-Antikainen, H. (Toim.) Etiikkaa monitieteisesti, Pohdintaa ja kysymyksiä. Kuopio 2008, Kuopio University Publications F. University Affairs 45. 224 p.

Assessment methods and criteria:

Homework assignments affect the course grade. Examination or a learning diary.

Person responsible:

Professor Riitta Keiski

477307S: Research Methodology, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

480311S Research Methodology 3.5 op

ECTS Credits:

5 cr

Language of instruction:

English

Timing:

Implementation in periods 2-6.

Learning outcomes:

Objective: To familiarise the student with scientific research, scientific methods and data handling, especially in process and environmental engineering. The course will give the student the basis to do the research work and motivates him/her to begin post-graduate studies. The course gives the student team working skills and increases the co-operation between the students and the research and teaching staff. The students are exposed to experiences in co-operation between different fields of science, industry, and other universities and laboratories, as well as the skills for doctoral studies.

Learning outcomes: After the course the student is able to define the role of research and different stages of research work. The student is also able to classify the stages and the subtasks of research work as well as important elements related to research, i.e. literature search, experimental work, and data processing. In addition, the student can evaluate the amount of work needed in research stages. The student can write scientific text and use references appropriately. The student also has the ability to recognise ethical issues related to research and analyse the meanings of those. He/she can use the principles of good scientific practises and is able to apply knowledge to research work.

Contents:

1) Science and research politics. 2) Research education. 3) Fundamentals of philosophy of science. 4) Starting research work: research types, funding, the process of research work, finding the research area, choosing the research topic, information sources. 5) Research plan and collecting data, experimental methods and significance of the variables, systematic experimental design, collecting experimental data, test equipment, reliability of the results, problems in laboratory experiments, modelling and simulation. 6) Mathematical analysis of results. 7) Reporting: writing a scientific text, referring, writing diploma, licentiate and doctoral theses, or reports. 8) Other issues connected to research work: ethical issues, integrity, and future. 9) Examples of scientific research in practice.

Learning activities and teaching methods:

Miniproject based on lectures in Optima during autumn term, contact lectures, laboratory training period during spring term.

Recommended or required reading:

Melville, S & Goddard, W: Research Methodology; An Introduction for Science and Engineering Students. Kenwyn 1996, Juta & Co. Ltd. 167 p. Hirsijärvi, S., Remes, P. & Sajavaara, P.: Tutki ja kirjoita. Jyväskylä 2004, Gummerus Kirjapaino Oy. 436 p. Material introduced in the lectures.

Additional literature : Paradis, J.G. & Zimmermann, M.L.: The MIT Guide to Science and Engineering Communication, 2nd ed. Cambridge 2002, The MIT Press, 324 p. Nykänen, O.: Toimivaa tekstiä, Opas tekniikasta kirjoittaville. Helsinki 2002, Tekniikan Akateemisten Liitto TEK. 212 p.

Assessment methods and criteria:

Optima exercises (miniproject) and laboratory training

Person responsible:

University researcher Mika Huuhtanen

555326S: Research Project in Production Management, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Kess, Pekka Antero

Opintokohteen kielet: Finnish

Leikkaavuudet:

555379S Research Project in Industrial Engineering and Management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish

Learning outcomes:

Aim: Applying the methods of production management in a company's activities and development. On the course the student can combine and apply earlier gained knowledge in the form of a wide study. The student familiarizes with research work and reporting of the results.

Learning outcomes: After finishing the course, the student will be able to systematically analyze and develop operations of a company by utilizing methods of production management. The student can also present research areas related to production management and can evaluate research of the area and discuss it critically.

Contents:

Changing content on topical subjects.

Learning activities and teaching methods:

The methods are agreed with the instructor of the work. Research plan, familiarizing with related literature, solving the problem and a literary report are required to pass. The work can be done individually or in a group.

Recommended or required reading:

Depending on the topic.

465075A: Research Techniques for Materials, 3,5 op

Voimassaolo: - 31.07.2021

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Karjalainen, Pentti

Opintokohteen kielet: Finnish

Leikkaavuudet:

465105A Research techniques for materials 5.0 op

Language of instruction:

Finnish

Learning outcomes:

This course gives an introduction to the broad spectrum of experimental techniques used in materials research, excluding materials testing. The principles, advantages and limitations of the various methods and their field of applications are described.

Learning outcomes: Upon completing of the required coursework, the student can explain the structure, functioning and contrast formation as well as factors affecting the resolution of various metal microscopes. He/she is also able to explain the concepts of the thermal analysis, dilatometry, and magnetic and electrical measurements and list typical applications for these techniques and methods.

Contents:

Optical microscopy; Transmission and scanning electron microscopes; Microanalysis; Quantitative metallography and image analysis; Spectroscopic methods; Thermal, dilatometric, electric and magnetic methods; Measurement of residual stresses; Demonstrations of some techniques

Learning activities and teaching methods:

Lectures and demonstrations will be held during the 1st period. The final assessment will be in the form of a final exam.

Study material: Lecture notes

Kettunen, P.O.: Elektronimikroskopia I ja II, Otakustantamo: Espoo, 1983

477113S: Research Training of Pulp and Paper Technology, 10 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Ämmälä

Opintokohteen kielet: Finnish

Leikkaavuudet:

477133S	Research training of bio and circular economy	5.0 op
477131S	Characterisation of biobased materials	5.0 op
477130S	Research training of bio and circular economy	10.0 op
477127S	Research training of bioproduct technology	10.0 op

ECTS Credits:

8,0 credits

Language of instruction:

Finnish

Timing:

Implementation in period 1-6.

Learning outcomes:

Objective: to give skills for performing an experimental research project.

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

Contents:

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

Learning activities and teaching methods:

Lab exercises under a supervision of research scientists. Written report and presentation of the project results.

Recommended optional programme components:

Participation in the course is possible only those students having a major in the Advanced Special Module of Pulp and Paper Technology.

Assessment methods and criteria:

Research report in the form of scientific paper. Presentation of the results for research group.

Person responsible:

Postdoctoral Research Fellow Ari Ämmälä

555321S: Risk Management, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Hanna Kropsu-Vehkaperä

Opintokohteen kielet: English

Leikkaavuudet:

555377S	Risk Management	5.0 op
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Voidaan suorittaa useasti: Kyllä

Language of instruction:

English

Learning outcomes:

The course familiarizes a student with the overall concept of risk management. During the course we cover the classification of risks in business and the different methods of risk management. Learning outcomes: After completing the course student knows the key concepts of risk and risk management and can explain these. The student can describe risk classifications and can explain the importance of the risk management to organisations.

The student can analyse business risks from new point of view and can produce improvement proposals based on the risk analysis. After the course the student can take part in the organisational development in a role of an expert in the area of risk management.

Contents:

Theoretical definition of risks. Risks in entrepreneurship and their classifications. Methods of risk management. Tools for corporate risk management.

477702A: Rock Engineering, 5 op

Voimassaolo: - 31.07.2014

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Mikael Rinne

Opintokohteen kielet: Finnish

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 2nd period.

Learning outcomes:

The student will learn about the fundamental concepts in rock mechanics.

Learning outcomes: After the course the student is able to explain the fundamental concepts in rock mechanics and blasting engineering as well as the unit processes in rock excavation, and is able to apply these in rock excavation done with different excavation machines in different situations.

Contents:

Fundamentals in rock mechanics. Rock drilling and mechanical excavation methods. Fundamentals in rock blasting. Open pit and underground mining methods. Muck handling. Raising and shaft sinking. Rock reinforcement. Ventilation and dewatering. Selection of machinery and equipment.

Learning activities and teaching methods:

Lectures and mine visit.

Recommended optional programme components:

Bachelor level studies in process engineering or respective knowledge

Recommended or required reading:

Lecture materials delivered in the lectures and / or in Optima. Additional literature: Hakapää A. & Lappalainen P. (eds.) 2009: Kaivos- ja louhintatekniikka. Opetushallitus, Kaivannaisteollisuusyhdistys 2009. 388 p. ISBN 978-952-13-3488-7

Assessment methods and criteria:

Participation to the mine visit and final examination.

Person responsible:

D.Sc. (Tech.) Pekka Särkkä or Mikael Rinne

555362S: Safety in Process Industry, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Väyrynen

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

Language of instruction:

Finnish.

Learning outcomes:

The course makes the student familiar with the design of process plant, which is characterised by proper ergonomic and safety features. The course also develops the abilities to analyse, enhance and maintain a high level of safety and productivity by means of modern management and leadership.

Learning outcomes : After the course the student is capable of identifying various hazards at the process plant. He is able to perform various safety analyses. He is also able to explain the impacts of technology, organization and person for risks and accidents. In addition, the student is able to make conception of the risk management as a part of safety management.

Contents:

For example: new EU standards and legislation. The methods of safety analysis and industrial maintenance.

Recommended optional programme components:

555260P Basic course in occupational safety.

Recommended or required reading:

Laitinen, H, Vuorinen, M & Simola, A: *Työturvallisuuden ja -terveyden johtaminen*. Tietosanoma, 2009. 494 s. Documentation about the issues from lectures and exercises, among others the material from TUKES, STM and TVL. www.vtt.fi/proj/riskianalyysit/ Other literature reported at the beginning of the course.

Advanced literature: Harms-Ringdahl, L.: *Safety analysis: principles and practice in occupational safety. Second edition. Taylor & Francis, 2001*. Bollinger, R. E. et al.: *Inherently safer chemical processes - a life cycle approach*. Center for Chemical Process Safety of the American Institute of Chemical Engineers 1996 (suitable chapters only).;

477042S: Scientific Communication, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Ämmälä

Opintokohteen kielet: Finnish

ECTS Credits:

5 cr

Language of instruction:

Finnish

Timing:

Implementation in 4th period every odd year.

Learning outcomes:

Objective: To adopt the basic principles of scientific writing and communication and to have skills for scientific presentations and publications (oral presentations, posters, publications, popular articles).

Learning outcomes : After the course the student is able to classify the different types of scientific publications. In the practical work the student is able to prepare an oral presentation and a written publication of his/her own research work (e.g. of the project work done during course 477307S Research Methodology).

Learning activities and teaching methods:

Lectures, discussions, independent work under personal guidance, practical work. Continuous assessment with several small examinations and the report of the practical work.

Recommended or required reading:

Hirsjärvi, S., Remes, P. & Sajavaara, P.: Tutki ja kirjoita. Jyväskylä 2004, Gummerus Kirjapaino Oy. 436 s. Additional literature : Nykänen, O.: Toimivaa tekstiä, Opas tekniikasta kirjoittaville. Helsinki 2002, Tekniikan Akateemisten LiittoTEK. 212 s.

773647S: Sedimentology, 6 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Geosciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Pekka Lunkka

Opintokohteen kielet: Finnish

ECTS Credits:

6 credits

Language of instruction:

finnish

Timing:

4th or 5th year

Learning outcomes:

To provide a complete picture on sedimentological processes and products.

Contents:

sedimentary environments, processes and products

Learning activities and teaching methods:

30 h lectures

Recommended or required reading:

Reading, H. G. 1996. Sedimentary Environments. Blackwell Science Ltd. 688 pp. And Coe, A. L. 2005. The Sedimentary Record of Sea-level Change. Cambridge University Press. 287 pp.

Assessment methods and criteria:

examination

Grading:

1-5/fail

Person responsible:

J. P. Lunkka

031050A: Signal Analysis, 4 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Mathematics Division

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

031080A Signal Analysis 5.0 op

Ei opintojaksokuvauksia.

477503S: Simulation, 3 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Esko Juuso

Opintokohteen kielet: English

Leikkaavuudet:

477523S Simulation 5.0 op

470448A Simulation 3.0 op

ECTS Credits:

3,0 cr

Language of instruction:

Finnish and English

Timing:

Implementation in 3rd period.

Learning outcomes:

The objective of the course is to provide advanced understanding on the methodologies and applications of simulation. Learning outcomes: After the course the student is capable of explaining the concepts and operation principles of process simulators. 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 event based, 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.

Learning activities and teaching methods:

The course consists of lectures, several exercises, a case study, two seminars and a final report. The case study covers several topics applied in a chosen problem. Each seminar presentation concentrates on a single topic. The final grade is based on the combined points from exercises, case study, seminar and the final report. Final exam is an alternative for the final report. Reports and exams can be done also in English.

Recommended or required reading:

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

Person responsible:

University teacher Esko Juuso

488122S: Statistical Methods in Hydrology, 5 op

Voimassaolo: 01.08.2011 - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pertti Ala-Aho, Björn Klöve

Opintokohteen kielet: English

Ei opintojaksokuvauksia.

555320S: Strategic Management, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Kess, Pekka Antero

Opintokohteen kielet: English

Leikkaavuudet:

555370S Strategic Management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

English

Learning outcomes:

The aim of the course is to familiarize a student with strategic thinking, business strategy development as well as the processes, methods, and tools involved with the management of change, in both theory and practice. Learning outcomes: After completing the course student knows the key concepts of strategic thinking, strategic management and strategic planning and can explain these. The student can describe structures and can

explain the importance of the strategic management to organisations. The student can analyse strategic management in companies and can produce improvement proposals based on the analysis. After the course the student can take part in strategic planning in organisations.

Contents:

Analysis of the structure of industry and anticipation of development possibilities. The basic types of competition strategy for an enterprise. Sources of competitive advantage. Strategic thinking. Development of a business strategy based on the core competences. Management of the company's strategy. Tools for strategic analysis. Special cases with the strategy process.

477703A: Surface Chemistry Principles of Minerals, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jaakko Rämö

Opintokohteen kielet: Finnish

Leikkaavuudet:

477716A Surface Chemistry Principles and Applications in Mineral and Mining Technology 5.0 op

ECTS Credits:

3,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 3rd period.

Learning outcomes:

The course introduces students to surface phenomena of physical chemistry.

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

Contents:

Basics of physical chemistry, chemical interactions, zeta potential, surface reagents, etc.

Learning activities and teaching methods:

Lectures

Recommended optional programme components:

Bachelor level studies in process engineering or respective knowledge.

Assessment methods and criteria:

Final examination.

Person responsible:

D.Sc. (Tech.) Jaakko Rämö

488402A: Sustainable Development, 3 op

Voimassaolo: 01.01.2009 - 31.07.2015

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

488402S Sustainable Development 5.0 op

ECTS Credits:

3,0 cr

Language of instruction:

English

Timing:

Implementation in 3rd period.

Learning outcomes:

To provide an understanding of the multidisciplinary nature and concept of sustainability and to clarify the patterns of resources use and the limits of the carrying capacity of natural systems; to outline the future perspectives on the prosperity of social and economic systems.

Contents:

Multidisciplinary, intensive and interactive course with pre-course and post-course assignments. Presentations on: Principles of sustainable development; Environmental justice (human rights, minority rights); Economic development and sustainability (poverty and equity); Social development and culture; Corporate sustainability or corporate social responsibility.

Learning activities and teaching methods:

Lectures, case studies, negotiation simulations, group projects. Course evaluation will be based on activity during the seminar and post-course assignment.

Recommended or required reading:

Material provided during the course.

Person responsible:

M.Sc. (Tech) Hanna Myllykoski

772333A: Technical mineralogy, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Geosciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Gehör

Opintokohteen kielet: Finnish

ECTS Credits:

5 credits

Language of instruction:

finnish

Timing:

2nd or 3rd year

Contents:

Occurrence and properties of non-metallic resources; mineralogy of technical mass-productions (ceramics, glass, cement, calc, zeolite, bentonite), mineralogy of progressive ceramic products; Properties and technical use of clayminerals and their sorption, modification and use in environmental technical applications. Reactive materials and their use in environmental technical applications.

Learning activities and teaching methods:

26 h lectures and 10 h exercises lectures

Assessment methods and criteria:

examination

Grading:

1-5/fail

Person responsible:

S. Gehör and K. Kujala

555340S: Technology Management, 4 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opettajat: Haapasalo, Harri Jouni Olavi

Opintokohteen kielet: English

Leikkaavuudet:

555350S Research and Technology Management 5.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:

English

Learning outcomes:

The aim of the course is to highlight the significance of technology from the perspective of competition. To present the speed of technological development and the effects that the scope of technology has on the operations of a productive firm. To create a basis for understanding the meaning of innovation. To create a link between organization strategy and technological strategy. Learning outcomes: After finishing the course, the student will be able to differentiate product development and technology management in a company. The student will be able to piece together the development needs and cycles of technologies in an organization. In addition, the student will know how to combine technology development and technology management with strategic planning of a company.

Contents:

The consists of defining technology and its role within an enterprise and within society. During the course we study the meaning of innovation in technological competition. The lifecycles of technology including development, acquirement, and movement are also covered.

488117S: Water Resources Management, 5 - 7,5 op

Voimassaolo: - 31.07.2017

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Björn Klöve

Opintokohteen kielet: English

Leikkaavuudet:

480170S Environmental Impact Assessment and Diminishing Harmful Effects in Water Resource Management
5.0 op

480212S Environmental Construction 3.5 op

ECTS Credits:

7,5 cr

Language of instruction:

Finnish

Timing:

Implementation in 1st-2nd periods.

Learning outcomes:

To introduce basic phenomena which must take into account in utilization of water resources. To familiarize students with statistical methods generally used in water resources management.

Contents:

Statistical methods, open channel flow, river flow, Her-Ras model and its applications.

Learning activities and teaching methods:

Lectures, designing and modelling tasks I-III: I-II) Statistical methods generally used in water resources management. III) Modelling river flow with Hec-Ras.

Recommended optional programme components:

Hydrological Processes.

Recommended or required reading:

Physical Hydrology (Dingman S.L., 2002, ISBN 978-1-57766-561-8), lecture notes and other material and literature given in lectures.

Assessment methods and criteria:

Report about assignments (grade 1-5) and the final examination (accepted/not accepted).

Person responsible:

Professor Björn Klöve

Other information:

Lectures are given every second years.

488105A: Water Supply Networks, 5 op

Voimassaolo: 01.08.2005 - 31.07.2017

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jarmo Sallanko, Pekka Rossi

Opintokohteen kielet: Finnish

Leikkaavuudet:

480120A Water Distribution and Sewerage Networks 3.5 op

ECTS Credits:

5,0 cr

Language of instruction:

Finnish

Timing:

Implementation in 5th period.

Learning outcomes:

To give good knowledge about water distribution and collection of wastewater, design and use. Drainage water management in urban areas.

Learning outcomes: Student knows and understands those systems what are needed for water distribution and waste water and storm water collection. Student is able to do basic dimensioning for water distribution network and sewer system of population centre.

Contents:

Water and drainage pipe design and dimensioning. Pumping and storage tanks needed in distribution of water and collection of sewage water. Control and automation of pumping stations. Observations in pipelines to prevent corrosion, effects of cold climate and harmful hydraulic impacts.

Learning activities and teaching methods:

Lectures and a design exercise.

Recommended optional programme components:

Introduction to Environmental Engineering or at least equivalent information about water management. Course Hydrological Processes and Mass Transfer recommended beforehand.

Recommended or required reading:

Lecture handout and other materials delivered in lectures. To the appropriate extent: RIL 124-1.2003: Vesihuolto I (ISBN 951-758-503-3), RIL 124-2.2004: Vesihuolto II (ISBN 951-758-438-5), Water distribution systems handbook. 2000 (ISBN 0-07-134213-3). Vesihuoltoverkkojen suunnittelu - perusteet ja toiminnallisuus (ISBN 978-951-758-526-2). RIL 237-2-2010, Vesihuoltoverkkojen suunnittelu - mitoitus ja suunnittelu (ISBN 978-951-758-521-7).

Assessment methods and criteria:

Examination and a design exercise.

Person responsible:

Laboratory engineer Jarmo Sallanko

488110S: Water and Wastewater Treatment, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

480151S Water and Wastewater Treatment 7.0 op

480208S Industrial Water and Wastewater Treatment 3.5 op

ECTS Credits:

7,5 cr

Language of instruction:

English

Timing:

Implementation in 1st-2nd periods.

Learning outcomes:

To familiarize the student with the unit operations of water and wastewater treatment used in communities and industry.

Contents:

Biological, chemical and mechanical treatment methods, design practise and control of water and wastewater treatment. Handling, utilization and final displacement of waste water sludge. Wastewater treatment of communities and industry. On-site treatment systems.

Learning activities and teaching methods:

Lectures and 2 assignments.

Recommended optional programme components:

Introduction to Environmental Engineering or equivalent knowledge about water management.

Recommended or required reading:

Handout and other materials delivered in lectures. Soveltuvien osin: RIL 123-1.2003: Vesihuolto I (ISBN 951-758-503-3), RIL 124-2.2004: Vesihuolto II (951-758-438-5), AWWA, ASCE: Water Treatment Plant Design, McGraw-Hill, 2005 (ISBN 0-07-141872-5); Metcalf & Eddy: Wastewater Engineering, Treatment and Reuse, 4th edition, McGraw-Hill, London 2003 (ISBN 0-07-112250-8); AWWA (Letterman, R.D. tech. editor): Water Quality and Treatment, McGraw-Hill, London 1999 (ISBN 0-07-001659-3).

Assessment methods and criteria:

Examination and assignments.

Person responsible:

Laboratory engineer Jarmo Sallanko

783619S: Wood Chemistry, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Chemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Hormi Osmo

Opintokohteen kielet: Finnish

ECTS Credits:

3 credits

Language of instruction:

Finnish

Timing:

4th or 5th autumn or spring. The course is lectured every other year next time during the autumn 2012.

Learning outcomes:

After passing the course the student can explain the chemical composition of wood and the chemistry involved in chemical pulping of wood.

Contents:

The structure of wood, chemistry of carbohydrates, polysaccharides of wood, lignin, extractives, bark, pulping chemistry, bleaching.

Learning activities and teaching methods:

24 hours of lectures

Target group:

Chemistry, optional

Recommended optional programme components:

Introduction to Organic Chemistry (780103P)

Recommended or required reading:

Sjöström, E.: Wood Chemistry: Fundamentals and Applications, Academic Press, New York 1981.

Assessment methods and criteria:

Final examination

Grading:

1-5/fail

Person responsible:

Prof. Osmo Hormi

