Opasraportti

Department of process and environmental engineering (2010 - 2011)

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. Recearch, 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 CO_2-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.

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
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
488204S: Air Pollution Control Engineering, 5 op
488306S: Applied Microbiology, 7 op
781625S: Aquatic Chemistry, 4 op
477032A: AutoCAD in Process and Environmental Engineering, 2 op
477508S: Automation in Metallurgical Industry, 5 op
477507S: Automation in Pulp and Paper Industry, 5 op
488990A: Bachelor's Thesis / Enviromental Engineering, 8 op
477990A: Bachelor's Thesis / Process Engineering, 8 op
477701A: Basic Course in Geology, 4 op
555261A: Basic Course in Occupational Psychology, 3 op
555260P: Basic Course in Occupational Safety and Wellbeing at Work, 3 op
555240A: Basic Course in Product Development, 3 op

555280P: Basic Course of Project Management, 2 op
555281A: Basic Course of Quality Management, 5 op
761101P: Basic Mechanics, 4 op
780109P: Basic Principles in Chemistry, 4 op
780372A: Basic Principles of Green Chemistry, 4 op
488302A: Basics of Biotechnology, 5 op
488113S: Basics of surface water quality modelling, 5 op
740148P: Biomolecules, 5 op
488307S: Bioprocess Engineering, 7 op
488304S: Bioreactor Technology, 6 op
477208S: Biorefineries, 3 op
477102A: Bulk Solids Handling, 4 op
031010P: Calculus I, 5 op
782627S: Chemical Applications in Hazardous Waste Management and Environmental Technology, 4 op
477204S: Chemical Engineering Thermodynamics, 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
477602A: Control System Analysis, 4 op
477603A: Control System Design, 4 op
555363S: Creativity at Work and in Product Development, 5 op
464088S: Diagnosis of Machine Condition, 8 op
031017P: Differential Equations, 4 op
477605S: Digital Control Theory, 4 op
761103P: Electricity and Magnetism, 4 op
780373A: Environmental Chemistry, 3 op
488201A: Environmental Ecology, 5 op
488103A: Environmental Impact Assessment, 4 - 8 op
- *Alternative*
  - 488103A-01: Environmental Impact Assessment, Module 1, 3 - 4 op
  - 488103A-02: Environmental Impact Assessment, Module 2, 1 - 4 op
  - 488103A-03: Environmental Impact Assessment, Module 3, 1 op
  - 488103A-04: Environmental Impact Assessment, Module 4, 1 op
  - 488103A-05: Environmental Impact Assessment, Module 5, 1 op
  - 488103A-06: Environmental Impact Assessment, Exercise, 1 op

488405S: Environmental Issues in the Barents Region, 5 op
488012A: Environmental Legislation, 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
477502A: Experiment design and analysis, 5 op
781633S: Experimental Design, 4 op
477041S: Experimental Design, 5 op
477606S: Fault Diagnosis and Process Performance Analysis, 2 op
477705S: Field Course in Economic Geology, 2 op
754616S: Field methods in freshwater biomonitoring, 4 op
461033A: Finite Element Methods I, 3,5 op
477305S: Flow Dynamics, 5 op
477101A: Fluid and Particle Engineering I, 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
477302A: Heat Transfer, 3 op
555325S: Human Resources Management, 3 op
773331A: Hydrogeology, 5 op
488102A: Hydrological Processes, 5 op
488203S: Industrial Ecology, 5 op
477207S: Industrial Water and Wastewater Technologies, 5 op
488104A: Industrial and municipal waste management, 5 op
030005P: Information Skills, 1 op

477012P: Introduction to Automation Engineering, 5 op
488011P: Introduction to Environmental Engineering, 5 op
774329A: Introduction to Environmental Geochemistry, 5 op
488403A: Introduction to Environmental Legislative Systems of the Barents Region, 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
780112P: Introduction to Organic Chemistry, 4 op
477011P: Introduction to Process and Environmental Engineering I, 5 op
488410A: Introduction to Sustainable Energy, 10 op
762135P: Introduction to global environmental geophysics, 6 op
488401A: Introduction to the Environmental and Socio-economical Issues of the Barents Region, 2 op
780122P: Introductory Laboratory Course in Chemistry, 3 op
477112S: Laboratory Exercise of Pulp and Paper Technology, 3 op
488118S: Laboratory Exercises and Field Measurements in Environmental Engineering, 10 op
761121P: Laboratory Exercises in Physics 1, 3 op
477409S: Laboratory Exercises of Metallurgy, 4 op
477021A: Laboratory Exercises of Process Engineering, 4 op
464051A: Machine Drawing, 3,5 op
555361A: Machine Safety and Usability, 3,5 op
464087A: Maintenancy Technology, 5 op
477303A: Mass Transfer, 3 op
477201A: Material and Energy Balances, 5 op
465061A: Materials Engineering I, 5 op
031044A: Mathematical Methods, 4 op
031019P: Matrix Algebra, 3,5 op
477105S: Mechanical Pulping, 3 op
477406S: Melting and Solidification, 4 op
740149P: Metabolism I, 4 op
740375A: Metabolism II, 4 op
488301A: Microbiology, 3 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
477301A: Momentum Transfer, 3 op
477308S: Multicomponent Mass Transfer, 5 op
477306S: Non-ideal Reactors, 5 op
031022P: Numerical Analysis, 5 op
477724S: Numerical Mine Modelling, 5 op
030001P: Orientation Course for New Students, 1 op
477407S: Oxidation and Reduction in Pyrometallurgy, 5 op
464074S: Paper Machinery Construction, 7 op
477107S: Paper and Board Manufacturing, 3 op
464085A: Patenting, 3,5 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
477001A: Practical Training, 3 op
488001A: Practical Training, 3 op
477704A: Principles of Mineral Processing, 5 op
477108S: Printing Technology, 3 op
031021P: Probability and Mathematical Statistics, 5 op
477601A: Process Automation Systems, 4 op
477501A: Process Control Engineering I, 5 op
477203A: Process Design, 5 op
477610S: Process Information Systems, 5 op

477504S: Process Optimization, 4 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
477033A: Programming in Matlab, 2,5 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
477103A: Pulp and Paper Technology, 3 op
555380S: Quality Management, 5 op
477202A: Reactor Analysis, 4 op
477106S: Recycling of Bioproducts, 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 Bioproduct 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
901008P: Second Official Language (Swedish), 2 op
477304A: Separation Processes, 5 op
477503S: Simulation, 3 op
477408S: Slags and Slag Formation in Pyrometallurgy, 5 op
477604S: Software and Calculation Tools in Control Engineering, 3 op
555323S: Sourcing Management, 3 op
555320S: Strategic Management, 5 op
477402A: Structure of Solid Materials, 5 op
477703A: Surface Chemistry Principles of Minerals, 3 op
477405S: Surfaces and Phase Boundaries in Pyrometallurgy, 4 op
488402A: Sustainable Development, 3 op
900060A: Technical Communication, 2 op
773316A: Technical Properties of Sediments, 8 op
772333A: Technical mineralogy, 5 op
555340S: Technology Management, 4 op
555263A: Technology, Society and Work, 2 op
477401A: Thermodynamic Equilibria, 5 op
477404S: Thermodynamics of Hydrometallurgical Solutions, 3 op
477403S: Thermodynamics of Pyrometallurgical Solutions, 5 op
555262A: Usability and Safety in Product Development, 3 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 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*** . Otatieto 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:
5,0 credits
Language of instruction:
English
Timing:
Implementation in 2nd period every odd year in autumn.
Learning outcomes:
The aim of the course is to give the becoming engineers interdisciplinary skills in material and surface science, new catalyst preparation methods and application areas, catalytic reaction and process engineering, and methods in catalyst research (experimental and computational methods). It also gives skills to do research work by emphasizing research methods and innovations in catalysis.
Learning outcomes: After completing the course the student can explain the interdisciplinary connection of catalysis with material and surface science, define new catalyst preparation methods and application areas, catalytic reaction and process engineering, and methods in catalyst research (experimental and computational methods). He/she is also able to design and do research work by emphasising research methods and innovations in catalysis. He/she is able to explain the latest knowledge connected to catalyst research and applications. He /she is also capable of explaining the relation and differences between heterogeneous, ho-mogeneous and biocatalysis.
Contents:
The course contents is divided into the following themes 1) surface chemistry and catalysis, 2) new catalyst preparation methods, 3) catalysis for a sustainable production and energy, and green chemistry and technology and catalysis, 4) design of catalysts and catalytic processes (reactor and process intensification, process improvements, new catalysts and catalytic processes, new op-portunities by catalysis), 5) phenomena integration and catalysis and 6) new innovations in catalyst research.

Learning activities and teaching methods:
60 hours. Design exercises. Written examination. This course is proposed to be taken within the Research module.
Recommended optional programme components:
The course on Environmental and Process Catalysis.
Recommended or required reading:
Thomas, J.M. & Thomas, W.J.: Principles and Practice of Heterogeneous Catalysis. Weinheim 1997. 657 s.; Somorjai, G.A.: Surface Chemistry and Catalysis. New York 1994. 667 s.; Van Santen, R.A., van Leuwen, P.W.N. M., Moulijn, J.A. & Averill, B.A.: Catalysis: An Integrated Approach, 2nd. edition. Research Articles.
Further literature: Ertl, G., Knözinger, H. & Weitkamp, J.: Handbook of Heterogeneous Catalysis. Vol. 1-5. Weinheim 1997; Mor-bidelli, M., Gavriilidis, A. & Varma, A.: Catalyst Design, Optimal Distribution of Cata-lyst in Pellets, Reactors, and membranes. New York 2001, Cambridge University Press. 227 s.
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, it is possible to complete the course in English.
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:
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. Examination and/or project work
Recommended or required reading:
Lecture handout; Ikonen, E. & Najim, K.: Advanced Process Identification and Control, Marcel Dekker Inc., New York 2002. 310 pp.
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:
Prerequisities: The preceeding 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

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 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

300002M: 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

Ei opintojaksokuvauksia.

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:
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:
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: Tanskanen, Juha Petri

Opintokohteen kielet: English

Leikkaavuudet:

477223S	Advanced Process Design	5.0 op

ECTS Credits:
6,0 credits
Language of instruction:
Finnish and English

Timing:
Implementation in 2nd-3rd periods.
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:
Seider, W.D., Seider, J.D. and Lewin, D.R. Product and process design principles: Synthesis, analysis and evaluation. John Wiley & Sons, 2004. 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:
4,0 credits
Language of instruction:
English
Timing:
Implementation in 6th period every even year in spring.
Learning outcomes:
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 re-searchers. 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 mem-branes, 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: Funda-mentals, 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:
48 hours of lectures. With the lectures the students will familiarize themselves to the latest research publications. Seminars. Written examination. This course is proposed to be taken within the Research module.

Recommended optional programme components:
The courses Separation Processes and Multicomponent Mass Transfer.

Recommended or required reading:
The course literature will be chosen when the course is planned. Latest scientific research articles.
Further literature: Separation Processes in the Food and Biotechnology Industries, Edited by: Grandison, A.S. & Lewis, M.J. 1996 Woodhead Publishing.

Person responsible:
Professor Riitta Keiski

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, NOx, 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: Johanna Panula-Perälä

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 and English
Timing:
Implementation in periods 1st-3rd.
Learning outcomes:
During this course the students will be trained on microbiological methods for monitoring micro¬organisms in natural habitats, and on methods to investigate the growth of micro¬organisms in different systems. Practice in research project planning, in different methods for the handling, culturing etc. of microbes used in bio-technology and environmental engineering, and in report writing and seminar presentation will train the student for conducting a scienticific research project.
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:
Prerequisities: 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:
University Teacher Johanna Panula-Perälä
Other information:
Course is primarily meant for the students of bioprocess engineering study option.

781625S: Aquatic Chemistry, 4 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Chemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Leena Kaila

Opintokohteen oppimateriaali:

Stumm, Werner , , 1996
Buffle, Jacques , , 1988
Opintokohteen kielet: Finnish

ECTS Credits:
4 credits
Language of instruction:
Finnish/English on demand.
Timing:
4th or 5th spring. The course is lectured every other year.
Learning outcomes:
After this course the student should understand chemistry of natural waters: chemical equilibrium and reaction rates in them. Models of natural waters, influences of pollution on them.
Contents:
Atmosphere-water-solid-interactions and regulation of the chemical composition of natural waters.
Learning activities and teaching methods:
32 hours of lectures, one final examination.
Target group:
Chemistry, optional.
Recommended optional programme components:
Introduction to Analytical Chemistry (780111P).
Recommended or required reading:
Stumm, W. and Morgan, J.J.: Aquatic Chemistry - Chemical Equilibria and Rates in Natural Waters, 3rd ed., John Wiley & Sons, New York, 1995; Buffle, J.: Complexation Reactions In Aquatic Systems: An Analytical Approach, Ellis Horwood Limited, Chichester, 1988.
Person responsible:
Lecturer L. Kaila

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

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) excercises. 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 inteeligent 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

488990A: Bachelor's Thesis / Enviromental 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.

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 / Enviromental Engineering 8.0 op

Ei opintojaksokuvauksia.

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.
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*** , Otatieto 2000. Other literature reported at the beginning of the course.

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.

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

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.

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

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 masters the basic concepts of mechanics and is able 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), four mini examinations and end examination or final examination.
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.
Person responsible:
Anita Aikio
Other information:
https://wiki.oulu.fi/display/761101P/

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 oppimateriaali:
Petrucci, Ralph H., , 2002
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, one final examination.
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.
Person responsible:
Lecturer M. 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.

780372A: Basic Principles of Green Chemistry, 4 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Chemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Minna Tiainen, Toivo Kuokkanen

Opintokohteen oppimateriaali:

Lancaster, Mike , , 2002

Opintokohteen kielet: Finnish

Leikkaavuudet:

780355A Environmental Chemistry and Hazardous Wastes 4.0 op
780360A Environmental Chemistry and Hazardous Wastes 5.5 op
780375A Basic Principles of Green Chemistry 2.0 op

ECTS Credits:
4 credits
Language of instruction:
Finnish.
Timing:
Spring.
Learning outcomes:
At the end of the course, the students should have acquired an understanding of twelve principles of green chemistry.
Contents:

Environmental friendly chemistry. The principles of green chemistry with examples of real life, classification, utilization, refining and disposal of environmentally hazardous wastes. Hazardous Waste Management of the University of Oulu.
Learning activities and teaching methods:
37 hours of lectures, one final examination.
Target group:
Chemistry, optional.
Recommended optional programme components:
Introduction to Chemistry (780113P) or Introduction to Physical Chemistry (780101P) and Introduction to Inorganic Chemistry (780102P) or Basic Principles in Chemistry (780109P).
Recommended or required reading:
Lancaster M.: Green Chemistry: An introductory text, RSC, 2002. Material given in the lecture (hazardous wastes).
Person responsible:
Lecturer Minna Tiainen and Doc. Toivo Kuokkanen.

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: Heikki Ojamo, Johanna Panula-Perälä

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

488113S: Basics of 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 harmfull 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 ordi-nary 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).

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 lipds 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, Johanna Panula-Perälä, Mursula, Anu Mari

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 and 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 bio¬technology, and in report writing and seminar presentation will train the student for conducting a scienticific research project.
Objectives: 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.
Person responsible:
University teacher Johanna Panula-Perälä
Other information:
Course is primarily meant for the students of bioprocess engineering study option.

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: Johanna Panula-Perälä, Heikki Ojamo

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:
Implemetation 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 processess, micborial 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 Micahelis-Menten models, reaction rates and their determination. The lag phase of growth, cellular maintenance, cell death. Kinetics of product and by-product formation. Kinetics of oxygen and heat transfer. Oxygen and heat balances: significance and calculations. Power consumption. Scale-up and scale-down.

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. Bioprosessitekniikka. 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

Timing:
Implementation in spring 2012.

Learning outcomes:
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.

Assessment methods and criteria:
Examination and other evaluation methods.

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: Niinimäki, Jouko Juhani, 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:
Upon completion of the course, a studen 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, separation from suspensions, mixing, properties affecting storage and transportation of granular material, storing of granular material, transportation of solid materials, mechanical conveyors, pneumatic and hydraulic transport, fluidization and granulation.
Learning activities and teaching methods:
Lectures and exercises. Contact instruction 36 h.
Recommended optional programme components:
Course 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:
Continuous evaluation or final exam. Literature exam for foreign students.
Person responsible:
Professor Jouko Niinimäki, Head assistant Ari Ämmälä

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

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. Two examinations or a final examination.
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).

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 oppimateriaali:

Clark, J.H., , 1995

Opintokohteen kielet: Finnish

ECTS Credits:
4 credits
Language of instruction:
Finnish
Timing:
4th or 5th spring. The course is lectured every other year.
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 + practical exercise, one final examination.
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.
Person responsible:
Doc. T. 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
Learning outcomes:

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, and 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 exercise
Person responsible:
Professor Juha Tanskanen

477104S: Chemical Wood Processing, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Mirja Illikainen, Niinimäki, Jouko Juhani

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 2nd period every even year in autumn.
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 based biorefinery.
Learning activities and teaching methods:
Lectures. 30 h. Excursion to a pulp mill.
Recommended optional programme components:
Required previous knowledge: Pulp and Paper Technology. Basics of chemistry and process engineering are also required.
Recommended or required reading:
Lecture materials and other materials that will be announced at the lectures.
Assessment methods and criteria:
Continuous evaluation or final exam. Literature exam for foreign students.
Person responsible:
Professor Jouko Niinimäki, University lecturer Mirja Illikainen

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. ***Työhygienia*** , 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 og Technology & University of Oulu, 1995. pp. 114-124.
Other information:
Course is taking place only every second year starting in 2004

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, it is possible to complete the course in English.
Timing:
Implementation in 1st-2nd periods.
Learning outcomes:
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. Examination.
Recommended or required reading:
Dorf, R.: Modern Control System. 11th ed. Prentice-Hall 2008, 1018 pp.; Ogata, K., Modern Control Engineering. 4th ed. Prentice-Hall 2002. 964 pp.
Additional literature *:* DiStefano, J.: Feedback and Control Systems. 2nd ed. Prentice-Hall 1990, 512 pp.; Ylen; J-P.: Säätötekniikan harjoitustehtäviä. Hakapaino Oy 1994. 252 pp.
Person responsible:
Professor Ensi Ikonen, Lecturer Jukka Hiltunen

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: Seppo Honkanen, Ikonen, Mika Enso-Veitikka

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, it is possible to complete the course in English.
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-loop systems 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. Examination
Recommended or required reading:
Dorf, R.: Modern Control System. 11th ed. Prentice-Hall 2008, 1018 pp.; Ogata, K., Modern Control Engineering. 4th ed. Prentice-Hall 2002. 964 pp.
Additional literature *:* DiStefano, J.: Feedback and Control Systems. 2nd ed. Prentice-Hall 1990, 512 pp.; Ylen; J-P.: Säätötekniikan harjoitustehtäviä. Hakapaino Oy 1994. 252 pp.

Person responsible:
Professor Enso Ikonen, Lecturer Jukka Hiltunen

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.

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

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:
Sinnish, it is possible to complete the course in English.
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.
Recommended or required reading:
Lecturer’s note. Landau & Zito (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.
Person responsible:
Assistent Seppo Honkanen
Other information:
Courses 470602A and 470603A are recommended beforehand. Course material is in English. The course concludes in a written exam; to request an exam in English, contact the lecturer via email beforehand.

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:
The student masters the basic concepts of electricity and magnetism and is able 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), four mini examinations and end examination or final examination.
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.
Person responsible:
Anita Aikio
Other information:
https://wiki.oulu.fi/display/761103P/

780373A: Environmental Chemistry, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Chemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Minna Tiainen

Opintokohteen oppimateriaali:

VanLoon, Gary W. , , 2000

Opintokohteen kielet: Finnish

Leikkaavuudet:

780359A Environmental Chemistry 4.0 op
780355A Environmental Chemistry and Hazardous Wastes 4.0 op

780316A Environmental Chemistry 2.0 op
780360A Environmental Chemistry and Hazardous Wastes 5.5 op

ECTS Credits:
3 credits
Language of instruction:
Finnish
Timing:
3rd autumn.
Learning outcomes:
At the end of the course, the students should have acquired an understanding of chemistry of atmosphere, hydrosphere and terrestrial environment.
Contents:
Fundamentals of environmental chemistry; chemistry of the soil, natural and waste waters and atmosphere, circulation of chemical compounds in the nature, chemical releases, environmentally toxic and other noxious compounds, environmental analytics and basics of physical measurements.
Learning activities and teaching methods:
30 hours of lectures, essay, one final examination.
Grading: 70% final examination, 30% essay.
Target group:
Chemistry, compulsory.
Recommended optional programme components:
Introduction to Chemistry (780113P) or Introduction to Physical Chemistry (780101P) and Introduction to Inorganic Chemistry (780102P) or Basic Principles in Chemistry (780109P).
Recommended or required reading:
van Loon, G.W. & Duffy, S.J.: Environmental Chemistry, A Global Perspective, Oxford, 2000.
Person responsible:
Lecturer M. Tiainen.

488201A: Environmental Ecology, 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:

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.

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 Assesment 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 Assesment: 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.

Alternative

488103A-01: Environmental Impact Assessment, Module 1, 3 - 4 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Intermediate Studies

Laji: Partial credit

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Björn Klöve

Opintokohteen kielet: English

Ei opintojaksokuvauksia.

488103A-02: Environmental Impact Assessment, Module 2, 1 - 4 op

Voimassaolo: 01.08.2010 -
Opiskelumuoto: Intermediate Studies
Laji: Partial credit
Vastuuyksikkö: Department of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Björn Klöve
Opintokohteen kielet: English

Ei opintojaksokuvauksia.

488103A-03: Environmental Impact Assessment, Module 3, 1 op

Voimassaolo: 01.08.2010 - 31.07.2012
Opiskelumuoto: Intermediate Studies
Laji: Partial credit
Vastuuyksikkö: Department of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Björn Klöve
Opintokohteen kielet: English

Ei opintojaksokuvauksia.

488103A-04: Environmental Impact Assessment, Module 4, 1 op

Voimassaolo: 01.08.2010 - 31.07.2012
Opiskelumuoto: Intermediate Studies
Laji: Partial credit
Vastuuyksikkö: Department of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Björn Klöve
Opintokohteen kielet: English

Ei opintojaksokuvauksia.

488103A-05: Environmental Impact Assessment, Module 5, 1 op

Voimassaolo: 01.08.2010 - 31.07.2012
Opiskelumuoto: Intermediate Studies
Laji: Partial credit
Vastuuyksikkö: Department of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Björn Klöve
Opintokohteen kielet: English

Ei opintojaksokuvauksia.

488103A-06: Environmental Impact Assessment, Exercise, 1 op

Voimassaolo: 01.08.2010 - 31.07.2012

Opiskelumuoto: Intermediate Studies
Laji: Partial credit
Vastuuyksikkö: Department of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Björn Klöve
Opintokohteen kielet: English

Ei opintojaksokuvauksia.

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

488012A: Environmental Legislation, 5 op

Voimassaolo: 01.01.2011 - 31.07.2017
Opiskelumuoto: Intermediate Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Eskelinen, Lauri Pertti Sakari, Iinatti, Heini Katariina
Opintokohteen kielet: English

Ei opintojaksokuvauksia.

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

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*** . Teknologiateollisuus. 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, Niinimäki, Jouko Juhani
Opintokohteen kielet: Finnish

ECTS Credits:
1,0 credits
Language of instruction:
Finnish
Timing:
Implementation in 5th period.
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:

Assessment methods and criteria:
Excursion to a Finnish research center and/or a mill in the field of forest industry and written report
Person responsible:
Professor Jouko Niinimäki, Head assistant Ari Ämmälä
Other information:
To participate in the excursion the student has to major in the Advanced Special Module of Pulp and Paper Technology.

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.

477502A: Experiment design and analysis, 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 prionciple 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

781633S: Experimental Design, 4 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Chemistry

Arvostelu: 1 - 5, pass, fail

Opettajat: Paavo Perämäki

Opintokohteen oppimateriaali:

Massart, D.L., Vandeginste, B.G.M., Buydens, L.M.C., De Jong, S., Lewi, P.J. ja Smeyers-Verbeke, J., , 1997

Opintokohteen kielet: Finnish

ECTS Credits:
4 credits
Language of instruction:
Finnish
Timing:
4th or 5th spring. The course is lectured every other year.
Learning outcomes:
After this course student becomes aware of importance experimental design and is able to apply most common experimental designs in the field of chemistry.
Contents:
Factorial designs, mixture designs, D-optimal designs, response surface methodology. Computer programmes are applied during the course in the design and analysis of experiments.
Learning activities and teaching methods:
30 hours of lectures, exercises: computer aided analysis of experimental data, one final examination.
Target group:
Chemistry, optional.
Recommended optional programme components:
Statistical Methods in Analytical Chemistry (781631S).
Recommended or required reading:
Massart, D.L., Vandeginste, B.G.M., Buydens, L.M.C., De Jong, S., Lewi, P.J. and Smeyers-Verbeke, J.: Handbook of Chemometrics and Qualimetrics: Part A, Elsevier, 1997.
Person responsible:
Prof. P. Perämäki

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:
5,0 cr
Language of instruction:
English
Timing:
Implementation in 4th period.
Learning outcomes:
To provide the student with understanding of the measurements uncertainty evaluation and calculation as well as ideas of implementing this information in experimental and computational research and measurements.
Learning outcomes: After this course the student knows the main software tools for experiment design and is able to use them. He can apply the main approaches for studying and evaluating the measurement reliability.
Contents:
Determining the uncertainty of measurements in chemical, physical and biochemical measurements, measurements reliability and traceability; Calculation examples supporting the learning of measurements uncertainty assessment preparation; Experimental design software (Modde, Minilab, Matlab tools); Experimental

design preparation and execution in laboratory scale research. Test methods and variable significance, reliability of experimental data;Problems in laboratory, pilot and full scale experiments, problems in modelling and in simulation.

Learning activities and teaching methods:
Lectures and practical work. Assessment during the course, by continuous evaluation with lecture exams, and written report of the practical work.

Recommended or required reading:
Material given in the lectures.

Person responsible:
Professor Kauko Leiviskä

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: Harri Aaltonen, Hiltunen, Jukka Antero

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, it is possible to complete the course in English.

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. Examination

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:
Research articles. Lecture handout. Additional literature: Will be announced later

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

754616S: Field methods in freshwater biomonitoring, 4 op

Voimassaolo: - 31.07.2015

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Biology

Arvostelu: 1 - 5, pass, fail

Opettajat: Muotka, Timo Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

754626S Field methods in freshwater biomonitoring 5.0 op

ECTS Credits:
4 cr.
Language of instruction:
Finnish.
Timing:
M.Sc. 1.-2. year.
Learning outcomes:
The course familiarises students with methods used in biomonitoring of lakes and rivers.
Contents:
Sampling methods as well as biological and ecotoxicological laboratory analysis are practiced. Survey methods used to describe the state of habitats are applied to lake and river environments.
Learning activities and teaching methods:
10 h lectures, 30 h field and laboratory exercises, group works.
Recommended optional programme components:
Courses 751307A and 754308A or equivalent knowledge.
Recommended or required reading:
Internet material, sample taking standards and instructions.
Assessment methods and criteria:
Group work.
Grading:
Pass / Fail.
Person responsible:
Prof. Timo Muotka.
Other information:
The course will take place if sufficient resources are available.

461033A: Finite Element Methods I, 3,5 op

Voimassaolo: 01.08.2007 - 31.07.2021

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Mechanical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Lumijärvi, Jouko Veikko Juhani

Opintokohteen kielet: Finnish

Leikkaavuudet:

461107A Finite Element Methods I 5.0 op
461014S Finite Element Methods 5.0 op

Language of instruction:
Finnish
Learning outcomes:
The aim of this course is for students to gain an understanding of the
basic idea and restrictions of FEM and the preparedness to the use of commercial FE-programs.
Learning outcomes: After this course, the student can explain the basic idea of the FEM. He/she can analyze simple truss- and frame structures and explain the theoretical background of the calculations. In addition, the student can analyze two-dimensional and heat transfer problems by using FEM.

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

Learning activities and teaching methods:
Lectures and exercises take place during periods 1 and 2. The course can be passed either by completing two mid-term exams or a final exam
Recommended optional programme components:
Strength of Materials I and II.
Recommended or required reading:
Lecture notes (in Finnish), N. Ottosen & H. Petersson: Introduction to the Finite Element Method, NAFEMS: A Finite Element Primer, O. C. Zienkiewcz & R. L. Taylor: The Finite Element Method, 4th ed, Vol. 1: Basic Formulation and Linear Problems.

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

Language of instruction:
Finnish
Learning outcomes:
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.
Learning activities and teaching methods:
Lectures and compulsory exercise done in small groups. Examination.
Recommended optional programme components:
Courses Momentum Transfer 477301A, Matrix Algebra and Numerical Methods are recommended.
Recommended or required reading:

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

Person responsible:
Laboratory engineer Esa Muurinen

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: Mirja Illikainen, 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:
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.

Learning activities and teaching methods:
Lectures and exercises. Contact instruction 30 h.

Recommended optional programme components:
Course 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:
Continuous evaluation or final exam. Literature exam for foreign students.

Person responsible:
Professor Jouko Niinimäki, University lecturer Mirja Illikainen

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:
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

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. 2 nd edition. 516 p
Person responsible:
Professor Rusanen

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:
To familiarise the student with properties of soil, geomaterials and by-products from industry, load, design and construction of geo- and environmental structures.
Contents:
Soils, geomaterials and by-products. Strength and deformation properties. Calculation of stability, Bearing and soil pressure. Seepage water flow. Soil strengthening, congealing and melting. Soil investigation.
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 passing the course the student knows various geophysical research methods of rock and soil.
Learning outcomes: After passing the course the student understands on which the use of geophysical methods in studying rock and soil is based. The student knows 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 petrophysical 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. Aerogeophysical methods. Borehole measurements.

Learning activities and teaching methods:
Lectures 30 h
Recommended or required reading:
Lectures, lecture notes. Peltoniemi, M. 1988: Maa- ja kallioperän geofysikaaliset tutkimusmenetelmät. To the appropriate extent Milsom, J. 1989: Field geophysics. Telford, W. M., Geldart, T. M. & Sheriff, R. E., 1990: Applied geophysics. Kearey; P., Brooks, M. & Hill, I., 2002: An introduction to geophysical exploration (3rd ed.); Parasnis, T. S., 1997: Principles of applied geophysics. (5th ed.); Reynolds, J. M., 1997: An introduction to applied and environmental geophysics; Sharma, P. V., 1997: Environmental and engineering geophysics.

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: 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. Students can estimate key factors influencing on discharge and water quality of groundwater. Students can use general methods to calculate groundwater flow and design sustainable use and management of groundwaters.
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. Calculus assignments can give 1-3 points for the examination.
Person responsible:
Professor Björn Klöve
Other information:
Lectures are given every second year, odd autumn periods.

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:
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. Homework assignments affect the course grade. Examination.
Recommended optional programme components:
Course Momentum Transfer 477301A recommended beforehand.
Recommended or required reading:
Bird, R, B., Stewart, W.E. & Lightfoot, E.N., Transport Phenomena, John Wiley & Sons, 1976, 780 pp.; Linnhoff, B. et al.: A User Guide on Process Integration for the Efficient Use of Energy, The Institution of Chemical Engineers, 1987, 247 pp.
Additional literature: Jokilaakso, A., Virtaustekniikan, lämmönsiirron ja aineensiirron perusteet, 496, Otakustantamo, 1987, 194 pp. Coulson, J.F. et al., Chemical engineering vol.1, 4th ed., Pergamon Press, 1990. 708 pp. Peters, M.S. & Timmerhaus, K.D., Plant design and economics for chemical engineers, 4th ed., McGraw-Hill, 1991, 910 pp. Sussman, M.V., Availability (exergy) analysis, Mulliken House, 1985, 94 pp.
Other information:

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. Garnegie 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 .

773331A: Hydrogeology, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Geosciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Pekka Lunkka

Opintokohteen kielet: Finnish

ECTS Credits:
5 credits
Language of instruction:
finnish
Timing:
2nd or 3rd year
Learning outcomes:
To learn basic concepts in hydrogeology and to introduce hydrogeological research methods.
Contents:
Hydrological cycle, especially phases of earth water and ground water, origin of ground water and its occurrence in Finnish soil and bedrock and in other sediment, karst and volcanic formations; examples from Finland and elsewhere; ground water on climatic peripheries; flow of ground water and well hydraulics; ground water research, geological geophysical methods; stable and radioactive isotopes; principles of hydrochemistry; quality of ground water; deep ground water research; mineral waters and thermal waters; artificial ground waters; contaminating of ground water and its protection.
Learning activities and teaching methods:
30 h lectures and exercises
Recommended or required reading:
Grundvatten, Teori & Tillämpning. Knutsson, G. & Morfeldt, C-O. Svensk Byggtjänst. 1993, 304 s. Maanalaiset vedet - pohjavesigeologian perusteet. Korkka-Niemi, K. & Salonen, V-P. Täydennyskoulutuskeskus. Turun yliopisto. 1996. 181 s. Pohjavesi ja pohjaveden ympäristö. Mälkki, E. Tammi.1999 304 s.
Assessment methods and criteria:
examination
Grading:
1-5/fail
Person responsible:
J. P. Lunkka

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:
6,0 cr
Language of instruction:
Finnish
Timing:
Implementation in 4th-5th periods.
Learning outcomes:
To provide a basic understanding of water flow and storage processes involved in the hydrological cycle and introduce engineering computational methods used to manage water resources in natural and man made environments.
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 24 h, exercises 12 h, 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 (accepted/not accepted), peer review (accepted/not accepted).
Person responsible:
Professor Björn Klöve
Other information:
The English version from the course is available.

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

Language of instruction:

Finnish

Learning outcomes:

Learning outcomes:

After completing the course student is able to figure out the importance of water in processes. He/she can evaluate optimised usages of water taking note of external requirements as well as technical and economical factors. He/she can select treatment and regeneration operations on the basis of case-specific needs.

Contents:

Measures and unit operations in industrial water treatment. Waste water formation reduction. Operation water manufacturing. Internal water technology and water purification. Operational reliability. Material considerations. Environmental technical aspects.

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.

Person responsible:

Professor Juha Tanskanen

488104A: Industrial and municipal 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.

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

Other information:
http://www.kirjasto.oulu.fi/index.php?id=738

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

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:
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

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: Jarmo Sallanko, Väisänen, Virpi Maria, Johanna Panula-Perälä

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:
(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 Virpi Väisänen, University teacher Johanna Panula-Perälä
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.

774329A: Introduction to Environmental Geochemistry, 5 op

Voimassaolo: 01.01.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Geosciences

Arvostelu: 1 - 5, pass, fail

Opettajat: Eero Hanski

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 credits
Language of instruction:
finnish
Timing:
2nd or 3rd year
Learning outcomes:
After the course students should have basic knowledge on the reactions that affect the behavior of harmful (mainly inorganic) substances in the environment.
Contents:
Concepts of the environment and environmental geochemistry; solution, hydrolysis and redox reactions of minerals, sorption and related geochemical processes, topical environmental problems (acid rain, decrease of ozone, greenhouse phenomenon, heavy metal fallout) from the viewpoint of geochemistry; buffer systems of nature; heavy metals in environment; acid mine drainage.
Learning activities and teaching methods:
30 h lectures, 12 h computer exercises
Recommended optional programme components:
Basic course in geochemistry (774301A)
Recommended or required reading:
Sawyer, Clair N., McCarty, Perry L., Parkin, Gene F., Chemistry for Environmental Engineering and Science, Boston, McGraw-Hill, 2003, p. 1-397 and Alloway, B. J. (ed.) Heavy Metals in Soils, London, Blackie Academic & Professional, 1995, p. 1-57.
Assessment methods and criteria:
examination
Grading:
1-5/fail
Person responsible:
E. Hanski

488403A: Introduction to Environmental Legislative Systems of the Barents Region, 5 op

Voimassaolo: 01.01.2009 - 31.07.2011

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Anna-Kaisa Ronkanen

Opintokohteen kielet: Finnish

ECTS Credits:
5,0 cr
Language of instruction:
English (parts for BEE students).
Timing:
Implementation in 5th-6th periods.
Learning outcomes:
To provide an understanding of the structure and differences between the legislative systems of EU, Finland, Norway and Russia.
Learning outcomes: Students have the skills to find relevant sources of information and apply current legislation.
Contents:
A roadmap of the legislative systems, especially sources from where relevant information can be found. Exercises to solve problem-based case-studies related to implementing legislation, especially in a cross-border cooperative environment, as well as comparing the different systems across the Barents region.
Learning activities and teaching methods:
Lectures and exercises.

Recommended or required reading:
Sources of material provided during the course.
Person responsible:
University lecturer Anna-Kaisa Ronkanen
Other information:
This course is organised in the BEE partner university context.

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
Opettajat: Keiski, Riitta Liisa, Väisänen, Virpi Maria
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, Assistent 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 oppimateriaali:
Eklund, Dan , , 1991
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.
Learning outcomes:

At the end of the course, the students should have acquired an understanding of 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, one final examination.
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.
Person responsible:
Prof. O. 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 Miekk-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 scarse 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

780112P: Introduction to Organic Chemistry, 4 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Chemistry

Arvostelu: 1 - 5, pass, fail

Opintokohteen oppimateriaali:
Hart, Harold , , 1999
Hart, Harold , , 1999

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, two intermediate examinations or one final examination.
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.
Person responsible:
Senior Assistant. Dr. J. Koskela
Other information:
Students attend the lectures of 780103 P Introduction of Organic Chemistry.

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: 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:
The goal is to understand industrial unit operations as well as the phenomena related to these operations on a descriptive level. It should however be noted that this course is not organised in English and it is impossible to pass it in any other language besides Finnish. Therefore there are no requirements for the non-Finnish-speaking students.
Learning outcomes **:** Student recognizes the most essential phenomena and unit operations (as well as their relations) that are related to industrial activities and process engineering. Additionally, (s)he recognizes the factors influencing industrial activities in such a way that enables her/him to include all the analytical skills (s)he will learn in the following courses to be a part of her/his ever increasing knowledge concerning process engineering as a science as well as practical activity. In other words the course helps student to create the foundation on which the information, views and attitudes concerning process engineering will be built in the later courses. In addition to this, student is able to use the essential vocabulary of the field and capable of recognizing more detailed vocabulary.
Contents:
The course is divided into four parts. The first one deals with flow chart diagrams, material and mass balances, energy balances, homogenous chemical equilibrium, kinetics of the homogenous reactions and reactors. The second one handles sieving and sorting, mixing, mechanical separation, filtering and grinding. The third part concentrates on agglomeration and granulation, structure and properties of the solid materials, phase transitions, oxidation and reduction and heterogeneous phase equilibria. The fourth part deals with momentum transfer, heat transfer, mass transfer and catalysis.
Learning activities and teaching methods:
The course is lectured in Finnish during the periods 1 to 3 during which the four parts of the course are taken separately. Please not the course is not organised for the English speaking students.
Recommended or required reading:
Material used during the course.
Person responsible:
University teacher Eetu-Pekka Heikkinen

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

Opettajat: Kirsi *Marita Puikkonen

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 Hll. International Energy Agency: Energy Sector Methane Recovery and Use. The Importance of Policy.
Person responsible:
Professor Bjørn R. Sørensen, Narvik University College

762135P: Introduction to global environmental geophysics, 6 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Physics

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
6 credits
Language of instruction:
Finnish
Timing:
2nd - 3th year
Learning outcomes:
After passing the course the student understands the physical principles of global environmental issues and the use of geophysical methods in local environmental studies.
Contents:
An overview of the physical principles of global environmental issues and the use of geophysical methods in environmental case studies. The structure of the Earth and its geophysical processes: solid earth, oceans, atmosphere, glaciers, groundwater, nuclear waste disposal and natural disasters. Follow-up measurements of environment. Principles of modeling the environment: the Earth as a system. Climate change and its consequences.
Learning activities and teaching methods:
Lectures 40 h and a written exercise and a final examination.
Target group:

Compulsory for students of geophysics in the B.Sc. degree. The course is suitable for all students interested in environmental issues.
Recommended or required reading:
A handout. Kakkuri, J. & Hjelt, S.-E., 2000: Ympäristö ja geofysiikka and parts of the following: Houghton, J., 2004: Global warming: The complete briefing (3rd ed.).
Person responsible:
Pertti Kaikkonen
Other information:
https://wiki.oulu.fi/display/762135P/

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 clarifyies 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

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

Language of instruction:
Finnish.
Timing:
1st autumn or spring.
Learning outcomes:

After this course the student is familiar with safety aspects in laboratory, can safety handle and use basic laboratory equipments in experiments. The student knows micro and semi-micro inorganic, analytical methods, is familiar with inorganic or organic synthesis and can determine the yield and purity.
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, one final examination.
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:
Laboratory works and final examination has to be completed within next two terms.
Grading:
Pass/fail
Person responsible:
Prof. M. Lajunen and teaching assistants.

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: Ville Liimatainen, Mirja Illikainen

Opintokohteen kielet: Finnish

Leikkaavuudet:

470113S	Pulp and Paper Technology, laboratory exercises	3.5 op

ECTS Credits:
3,0 credits
Language of instruction:
Finnish
Learning outcomes:
Upon completion of the course, a student can perform the laboratory disintegration and refining. The student can prepare laboratory sheets and can test their papertechnical properties. In addition, the student can analyse the measured data and can conclude and report the effect of refining on paper properties.
Contents:
Basic pulp and paper testing methods.
Learning activities and teaching methods:
Lab exercises. 40 h.
Recommended optional programme components:
Course Pulp and Paper Technology.
Assessment methods and criteria:
The exercise is done in pairs at the time appointed with the responsible person.
Person responsible:
Postdoctoral researcher Henrikki Liimatainen, University lecturer Mirja Illikainen

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:
5,0-8,0 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 students's comprehension to apply techniques and methods in practice.
Learning outcomes: The student can deter-mine 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 learn 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.
Other information:
The course is only for students of water engineering.

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:
Main aim is to learn to make safe physical measurements, use different measurement tools, read different scales, handle the data, calculate the error estimations and make a sensible report of the measurements. After this course the student is able to make laboratory experiments and reports independently.
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. Different measurements are made with different instruments. As a result the most probable value is determined as well as its errors. Five different works will be made during the course in groups of up to 8 students. 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). Written reports of the experiments and a written examination.
Target group:
Compulsory.
Recommended optional programme components:
Upper secondary school physics and mathematics.
Recommended or required reading:
English material is given from laboratory.
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

477409S: Laboratory Exercises of Metallurgy, 4 op

Voimassaolo: 01.08.2005 -

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:

470306S Laboratory Exercises in Process Engineering 3.5 op

Language of instruction:
Finnish.
Learning outcomes:
The student will have an idea about the laboratory research and industrial research projects. It should however be noted that this course is not organised in English and it is impossible to pass it in any other language besides Finnish. Therefore there are no requirements for the non-Finnish-speaking students. Learning outcomes: Student recognizes the factors that must be taken into account in experimental laboratory research and industrial campaigns. (S)he can also execute experimental research and/or process evaluation based on measurement data as a part of a research group and write a report in which the experimental results are considered and reflected from the perspective of theoretical knowledge. During the course student is also familiarized with experimental apparatus used in the pyrometallurgical research.
Contents:
Lectures: laboratory research and occupational safety. Laboratory exercises will be determined according to prevailing research work.
Learning activities and teaching methods:
Lectures, an exercise work in the laboratory of Process Metallurgy Laboratory and exercise works in the steelworks of Tornio and Raahe. Please not the course is not organised for the English speaking students.
Recommended optional programme components:
Courses Structure of Solid Materials, Surfaces and Phase Boundaries in Pyrometallurgy, Melting and Solidification, Slags and Slag Formation in Pyrometallurgy recommended beforehand.
Recommended or required reading:

Material will be distributed during lectures and exercises.

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:

470223A Laboratory Experiments of Chemical Process Engineering 3.5 op

Learning outcomes:
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.
Recommended or required reading:
Will be announced later.

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: Maintenancy 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.

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

Language of instruction:
Finnish
Learning outcomes:
Aim: 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. Homework assignments affect the course grade. Examination.
Recommended optional programme components:
Courses Momentum Transfer 477301A and Heat Transfer 477302A recommended beforehand.
Recommended or required reading:

Bird, R,B., Stewart, W.E. & Lightfoot, E.N.: Transport Phenomena, John Wiley & Sons, 1976, 780 pp.; King, C.J.: Separation Processes, McGraw-Hill, 1980, 850 pp.; Wesselingh J.A. & Krishna R.: Mass Transfer, Ellis Horwood, 1990, 243 pp.
Additional literature: Jokilaakso, A., Virtaustekniikan, lämmönsiirron ja aineensiirron perusteet, 496, Otakustantamo, 1987, 194 pp.; Coulson, J.F. et. al.: Chemical Engineering vol.1, 4th ed., Pergamon Press, 1990. 708 pp.; McCabe, W.L. et al.: Unit Operations of Chemical Engineering, 5th ed., McGraw-Hill, 1993, 1130 pp.
Person responsible:
University teacher Kaisu Ainassaari
Other information:

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

Language of instruction:
Finnish.
Learning outcomes:
Learning outcomes : By completing the course the student is able to apply the first law of thermodynamics to various chemical processes. Especially the student will acquire the skill to produce material and energy balances to chemical processes in the presence of stoichiometric constraints. The student can give examples of opportunities for computer-based simulation in chemical process engineering.
Contents:
Material and energy balances of processes taking into account chemical reaction. Introduction to the use of simulation programs.
Learning activities and teaching methods:
Lectures and small group exercises 30+10 hours.
Recommended or required reading:
Reklaitis, G.V.: Introduction to Material and Energy Balances. John Wiley & Sons, 1983.
Assessment methods and criteria:
Combination of examinations and group exercises.
Person responsible:
University Teacher Ilkka Malinen

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

031044A: Mathematical Methods, 4 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Mathematics Division

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Language of instruction:
Finnish
Timing:
Period 1-3
Learning outcomes:
The course objective is to give to students the basic knowledge of Fourier methods in engineering, how to compute Fourier series, Fourier transforms, Z-transforms and how to apply these transforms for solving some problems in engineering. Furthermore, in the course the student will be provided with the elements of multivariate calculus. Finally at the end of the course some elementary partial differential equations are introduced and solved by the Fourier techniques.
Learning outcomes: The student learns to compute the Fourier-series representaion of a periodic function and form its frequency spectrum. He/She is able to compute the Fourier-transform and its inver Fourier transform. The student is able to find the Z-transform of discrete sequence and perform the inverse Z-transform. As one of the learning outcomes the student is able to calculate the gradient of a function as well as the divergence and the curl of a vector field. Finally, he/she knows the basic analytic solution methods for the partial differential equations.
Contents:
Complex numbers. Fourier-series. Fourier-transform. Z-transform. Gradient, divergence and curl. Partial differential equations
Learning activities and teaching methods:
Lectures 4h/week. Two intermediate exams or one final exam.
Recommended optional programme components:
Calculus 1, Matrix algebra and Differential Equations.
Recommended or required reading:
- K. Ruotsalainen, Mathematical methods (lecture notes in finnish)
- Glyn James; Advanced Modern 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 _nd the solution of the system of linear equations. The student is able to recognise the vector space and can relate the consepts 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 linaer 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.

477105S: Mechanical Pulping, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Niinimäki, Jouko Juhani, Mirja Illikainen

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:
Finnih
Timing:
Implementation in 2nd period every odd year in autumn.
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:

Wood handling, mechanical and chemimechanical pulping, bleaching, and mechanical unit operations in pulping and bleaching.
Learning activities and teaching methods:
Lectures. 30 h.
Recommended optional programme components:
Course Pulp and Paper Technology.
Recommended or required reading:
Lecture materials and other materials that will be announced at the lectures.
Assessment methods and criteria:
Final exam. Literature exam for foreign students.
Person responsible:
Professor Jouko Niinimäki, University lecturer Mirja Illikainen

477406S: Melting and Solidification, 4 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Tanskanen

Opintokohteen kielet: Finnish

Leikkaavuudet:

470616S Casting and Solidification 3.0 op

Language of instruction:
Finnish
Timing:
Implementation in 1st period.
Learning outcomes:
Student passing the cource can describe the melting and solidyfying process of inorganic pure substances and multicomponent systems and factors having affects on these. Additionally, the student can read phase diagrams and predict behavior of inorganic materials exposed to changing conditions.The student can tell examples of industrial processes containing melting and solidifying processes and can give detailed describtions about phenomena acting in the progresses. It should however be noted that this course is not organised in English and it is impossible to pass it in any other language besides Finnish. Therefore there are no requirements for the non-Finnish-speaking students.
Learning outcomes *:* Student passing the cource can describe the melting and solidyfying process of inorganic pure substances and multicomponent systems and factors having affects on these.
Additionally, the student can read phase diagrams and predict behavior of inorganic materials exposed to changing conditions.The student can tell examples of industrial processes containing melting and solidifying processes and can give detailed describtions about phenomena acting in the processes.

Contents:
Melting and solidification of pure phases and substances, effect of alloyed compounds, multicomponent systems. Fundamentals of phase diagrams, application of phase diagrammatic approach and operations on the melting and crystallization of materials. Industrial examples containing continous casting of steel among others
Learning activities and teaching methods:
Contact teaching during the 1 st period, during which further information will be given concerning the examination. Please not the course is not organised for the English speaking students.
Recommended optional programme components:
Passing the course Structure of solid materials or equal knowledge. Sufficient knowledge about thermodynamics and mass and heat transfer.
Recommended or required reading:
Material used during the course.
Supplementary literary material **:** T o the appropriate extent of Heikkinen, E-P.: Metallurgin hyvä tietää, moniste 58: Pyrometallurgisten prosessien teoria (in Finnish). Other possible materials will be announched during the course.
Person responsible:

University teacher Pekka Tanskanen

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 should be able to understand in detail how cells transfrom energy for their needs.
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 practical 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 understand 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 is a module that extends many of the fundamentals that were introduced in the module Metabolism I. 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 as well as the biosynthesis and degradation of central metabolites and structural molecules of the cell, like amino acids and nucleotides. Special aspects of metabolism, like tissue specificity and physiological states, will also be studied. Photosynthesis will be studied in detail and principles of cellular traffic will be introduced.

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:
Metabolism I
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 II (740367A), except that it contains no practical component

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 (lectures) and english (practicals)
Timing:
Implementation in periods 2nd-3rd.
Learning outcomes:
This course aims to teach the students the basics of microbiology to build a foundation for their future 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 diffent 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 practicals 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, 10. tai uudempi painos. 0-13-049147-0; Salkinoja-Salonen M (toim.): Mikrobiologian perusteita. Helsingin yliopisto, 2002. Practicals: Course hand-out.

Assessment methods and criteria:
Lectures, lecture diary and exercises, practical exercises, laboratory note book, intermediate exams (välikokeet) /final examination. Grade will be composed of, lecture diary and exercises, practical exercises, laboratory note book, intermediate exams (välikokeet)/final examination.

Person responsible:
University teacher Johanna Panula-Perälä

Other information:
The course is arranged in co-operation with the Department of Biochemistry.

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 benefication; 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; Enviromental 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 af mining projects: basic theory, risk identification, assessment and handling.
Learning activities and teaching methods:
Lectures and excercises, 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 knowlwdge 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:
3,0 cr
Language of instruction:
Finnish
Timing:
Implementation in 6th period.
Learning outcomes:

Learning outcomes: After 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
Recommended or required reading:
Mutmansky: Introductory Mining Engineering, Wiley 2002
Assessment methods and criteria:
Exam.
Person responsible:
D.Sc. (Tech.) 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 Advaces 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 sizing of geoenvironmental materials and geostructures.
Contents:
Transportation of detrimental elements. Risk assessment. Design of initial and surface structures for waste final placement. Stability of landfills and seepage water drainage. Landscaping. Life cycle evaluation of geostruc-tures.
Learning activities and teaching methods:
Lectures, design and modelling assignments.
Recommended optional programme components:
Basics in Geoenvironmental Engineering, Advanced Geoenvironmental Engineering.
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: Martti Koski, 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

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:
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. Homework assignments affect the course grade. Examination.
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 pp. Additional literature: Jokilaakso, A., Virtaustekniikan, lämmönsiirron ja aineensiirron perusteet, 496, Otakustantamo, 1987, 194 pp. Coulson, J.F. et al., Chemical engineering vol.1, 4th ed., Pergamon Press, 1990. 708 pp. Shaw, C.T., Using computational fluid dynamics, Prentice Hall, 1992, 251 pp.
Person responsible:
University teacher Eero Tuomaala
Other information:

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: Muurinen, Esa Ilmari, Ainassaari, Kaisu Maritta

Opintokohteen kielet: Finnish

Leikkaavuudet:

470302S Multicomponent Separation 5.0 op

Language of instruction:
Finnish
Learning outcomes:
To make the student familiar with mathematical modelling 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 and exercises. Examination and a simulation exercise.
Recommended optional programme components:
Courses Mass Transfer 477303A, Separation Processes 477304A and Matrix Algebra recommended beforehand
Recommended or required reading:
Taylor, R. & Krishna, R.: Multicomponent Mass Transfer, John Wiley & Sons, 1993, 579 pp.; Henley, E. J. & Seader, J.D.: Equilibrium-stage Separation Operations in Chemical Engineering, John Wiley & Sons, 1982, 742 pp.
Additional literature: Walas, S.M.: Phase Equilibria in Chemical Engineering, Butterworth Publishers, 1985, 671 pp.
Person responsible:
Laboratory engineer Esa Muurinen

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

Language of instruction:
Finnish
Learning outcomes:
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 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:
60 hours lectures, including exercises. Examination.
Recommended optional programme components:
Courses 477201A Energy and Material Balances and 477202A Reactor Analysis 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 pp.
Person responsible:
Professor Riitta Keiski

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 spesific 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

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

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

Opettajat: Petteri Somervuori

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.

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 crecit.
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 2 nd or 3 rd 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.

477407S: Oxidation and Reduction in Pyrometallurgy, 5 op

Voimassaolo: 01.08.2005 -

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:

470618A Laboratory Work of Process Engineering 3.0 op

Language of instruction:

Finnish

Timing:

Implementation in 2nd period.

Learning outcomes:

Student passing the cource can characterize transformations of pyrometallurgical systems expoced to oxidation or reduction conditions. The student can use chemical reactions, phase transformations and system transformations as the describing tools. Additionaly, the student can tell examples about industrial processes using oxidation-reduction –reactions and can give detailed describtions about phenomena acting in the processes. It should however be noted that this course is not organised in English and it is impossible to pass it in any other language besides Finnish. Therefore there are no requirements for the non-Finnish-speaking students.

Learning outcomes: Student passing the cource can characterize transformations of pyrometallurgical systems expoced to oxidation or reduction conditions. The student can use chemical reactions, phase transformations and system transformations as the describing tools. Additionaly, the student can tell examples about industrial processes using oxidation-reactions and can give detailed describtions about phenomena acting in the processes.

Contents:

Prometallurgical reducton-oxidation reactions between gas-solid-, gas-liquid-, liquid-liquid- and solid-liquid phases, for example reduction of iron oxides. Industrial process applications: reduction reactions in the blast furnace, high temperature corrosion and reducton-oxidation reactions of the liquid steel.

Learning activities and teaching methods:

Contact teaching during the 2 nd period, during which further information will be given concerning the examination. Please not the course is not organised for the English speaking students.

Recommended optional programme components:

Passing the course Structure of solid materials or equal knowledge. Sufficient knowledge about thermodynamics and mass and heat transfer.

Recommended or required reading:

Material used during the course.

Supplementary literary material: T o the appropriate extent of Heikkinen, E-P.: Metallurgin hyvä tietää, moniste 58: Pyrometallurgisten prosessien teoria (in Finnish). Other possible materials will be announched during the course.

Person responsible:

Professor Timo Fabritius

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 and Board Manufacturing, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Mirja Illikainen, Timo Jortama

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 5th period every odd year in spring.
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. 30 h. Excursion to a paper mill
Recommended optional programme components:
Course Pulp and Paper Technology.
Recommended or required reading:
Lecture materials and other materials that will be announced at the lectures.
Assessment methods and criteria:
Final exam. Literature exam for foreign students.
Person responsible:
Lecturer Timo Jortama, University lecturer Mirja Illikainen

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

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

Opettajat: Karjalainen, Pentti

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

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, Jenö 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, exercises, simulation demonstrations and/or industrial visit. Examination. The course will be lectured annually. The course will be followed by a course on Power Plant Control.

Recommended or required reading:
T.Joronen, J. Kovács ja Y. Majanne (2007): Voimalaitosautomaatio. Suomen Automaatioseura Oy.

Person responsible:
Researcher Laura Lohiniva, Docent Jenõ 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: Jenö 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 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

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

Learning outcomes:
Aim: 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

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

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 Luhtaanmäkl

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:
3,0 cr
Language of instruction:
Finnish
Timing:
Implementation in 5th period.
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 u nit processes to optimal beneficiation process .

Learning activities and teaching methods:
Lectures. Includes an excursion to mills and a research institutes. A written final exam.
Recommended optional programme components:
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.
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: Niinimäki, Jouko Juhani, Ari Ämmälä

Opintokohteen kielet: English

ECTS Credits:
2,0
credits
Language of instruction:
Finnish
Timing:
Implementation in 5th period every even year in spring.
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 technologies 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. 20 h.
Recommended optional programme components:
Course Pulp and Paper Technology.
Recommended or required reading:
Lecture materials and other materials that will be announced at the lectures.
Assessment methods and criteria:
Final exam. Literature exam for foreign students.
Person responsible:
Professor Jouko Niinimäki, Head assistant Ari Ämmälä

031021P: Probability and Mathematical Statistics, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Mathematics Division

Arvostelu: 1 - 5, pass, fail

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).

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

477501A: Process Control Engineering I, 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 special 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. Gorden and Breach Science Publishers, New York 1970, 448 pp.
Person responsible:
Professor Kauko Leiviskä, Senior assistent Juha Jaako

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 credits
Language of instruction:
English
Timing:
Implementation in 4th-5th periods.
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:
Combination of examinations and group exercises 30 + 10 hours
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 examinations and group exercises
Person responsible:
University Lecturer Juha Ahola

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:
Implementation in 6th period every even year in spring.
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:
30 hours of lectures. Seminars.
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. 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:
Senior assistant Juha Jaako
Other information:
http://ntsat.oulu.fi/index.php?97

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

Language of instruction:
English or Finnish
Timing:
Implementation in 5th period.
Learning outcomes:
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:
60 hours. Lectures including design exercises. Examination.
Recommended or required reading:
Lecture handout; Richardson, J.T.: Principles of Catalyst Development. New York. 1989, 288 pp.; Janssen, F.J.J.G. & van Santen, R.A.: Environmental Catalysis. NIOK, Catalytic Science Series, Vol. 1. 1999. 369 pp.
Additional literature: Ertl, G., Knözinger, J. & Weitkamp, J.: Handbook of Heterogeneous Catalysis. Vol. 1-5. Weinheim. 1997, 657 p.; Thomas, J.M. & Thomas, W.J.: Principles and Practice of Heterogenous Catalysis. Weinheim 1997. 657 pp.; Somorjai, G.A.: Surface Chemistry and Catalysis. New York 1994, 667 pp.; van Santen, R.A., van Leuwen, P.W.N.M., Mouljin, J.A. & Averill, B.A.: Catalysis: An Integrated Approach, 2nd ed. Studies in Surface Science and Catalysis 123. Amsterdam 1999, Elsevier Sci. B.V. 582 pp.
Person responsible:
University lecturer 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

Opettajat: Karjalainen, Pentti

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.

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: Huuhtanen, Mika Ensio

Opintokohteen kielet: English

Leikkaavuudet:

488208A	Basics of production and use of energy	5.0 op
470057S	The Energy Economy of Industrial Establishments	3.5 op

ECTS Credits:
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 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 in 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 it’s 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.

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:
4,0 cr (107 h)
Language of instruction:
Finnish
Timing:
Implementation in 1st period.
Person responsible:
Senior assistant Juha Jaako

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 1st period every odd year in autumn.
Learning outcomes:
The student is able to regocnise the most important analytical methods used for analysing the pulp and fibre properties and knows what pulp properites they measure.

Contents:
Disintegration and laboratory beating of pulp, the most common strength and optical measurements of paper sheets, fiber properties of chemical and mechanical pulps, determination of kappa number and viscosity of pulp, pH, consistency, Schopper-Riegler number, CSF number, ash content of pulp and paper. Statistical data processing.
Learning activities and teaching methods:

Lectures and demonstrations.
Recommended optional programme components:
Course Pulp and Paper Technology 477103A.
Recommended or required reading:
Lecture materials and other materials that will be announced at the lectures.
Assessment methods and criteria:
Demonstrations, continuous evaluation or final exam.
Person responsible:
Laboratory engineer Tuomas Stoor, Head assistant 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: Tuomas Stoor, 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 5th-6th periods.
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: Actual research areas in pulp and paper industry.
Contents:
Actual research areas in pulp and paper industry.
Learning activities and teaching methods:
Lectures. 20 h.
Recommended optional programme components:
Course Pulp and Paper Technology.
Recommended or required reading:
The newest books and articles.
Assessment methods and criteria:
Seminar presentation, and acting as an opponent for another presentation.
Person responsible:
Head assistant Ari Ämmälä, Laboratory engineer Tuomas Stoor

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: Mirja Illikainen, Niinimäki, Jouko Juhani

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:
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 mechanical unit operations related to them. Structure and properties of fiber and interaction with water, fiber suspension and mechanical unit operations related to it.
Learning activities and teaching methods:
Lectures. Contact instruction 30 h.
Recommended or required reading:
Lecture materials and other materials that will be announced at the lectures.
Assessment methods and criteria:
Continuous evaluation or final exam.
Person responsible:
Professor Jouko Niinimäki, University lecturer Mirja Illikainen

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.

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

Language of instruction:
Finnish
Learning outcomes:
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 do initial reactor selection and sizing.
Contents:
Elementary reactions, kinetics of homogenous reactions. Reaction rate on the basis of experimental data. Modeling of ideal reactors. Yield, selectivity and reactor size. Heuristics for selecting reactor type and operation conditions.
Learning activities and teaching methods:
Lectures and small group exercises 30 + 8 hours.
Recommended or required reading:
Lecture handout. Levenspiel, O., Chemical Reaction Engineering. John Wiley & Sons, New York, 1972 (Chapters 1-8).
Assessment methods and criteria:
Combination of examination and group exercises
Person responsible:
University Lecturer Juha Ahola

477106S: Recycling of Bioproducts, 3 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Niinimäki, Jouko Juhani, Mirja Illikainen

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:
2,0 credits
Language of instruction:
Finnish
Timing:
Implementation in 2nd period every even year in autumn.
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, bleaching, and mechanical unit operations.
Learning activities and teaching methods:
Lectures. Contact instruction 30 h.
Recommended optional programme components:
Course Pulp and Paper Technology 477103A
Recommended or required reading:
Lecture materials and other materials that will be announced at the lectures.
Assessment methods and criteria:
Continuous evaluation or final exam. Literature exam for foreign students.
Person responsible:
Professor Jouko Niinimäki, University Lecturer Mirja Illikainen

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:
2 credits
Language of instruction:
Finnish (or English)
Timing:
Implementation in 4th period.
Learning outcomes:
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:
25 hours. Lectures and team work. Examination or a learning diary.
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.

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

Language of instruction:
Partly English.
Learning outcomes:
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:
Lectures, teaching in groups, project operation and demonstrations.
Recommended or required reading:
Melville, S & Goddard, W: Research Methodology; An Introduction for Science and Engineering Students. Kenwyn 1996, Juta & Co. Ltd. 167 pp. Hirsijärvi, S., Remes, P. & Sajavaara, P.: Tutki ja kirjoita. Jyväskylä 2004, Gummerus Kirjapaino Oy. 436 pp. Material introduced in the lectures.
Additional literature : Paradis, J.G. & Zimmermann, M.L.: The MIT Guide to Science and Engineering Communication, 2nd ed. Cambridge 2002, The MITPress, 324 pp. Nykänen, O.: Toimivaa tekstiä, Opas tekniikasta kirjoittaville. Helsinki 2002, Tekniikan Akateemisten Liitto TEK. 212 pp.
Person responsible:
University lecturer 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

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 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 Bioproduct 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, Mirja Illikainen

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:
3,0 credits
Language of instruction:
Finnish
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 scientifical paper.
Learning activities and teaching methods:
Lab exercises. 70 h.
Recommended optional programme components:
Course Pulp and Paper Technology.
Assessment methods and criteria:
During the course the student will work as a research assistant in a research project participating in the project work in its different phases under supervision of a researcher.
Person responsible:
Head assistant Ari Ämmälä, University lecturer Mirja Illikainen

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

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:
3,0 cr
Language of instruction:
Finnish
Timing:
Implementation in 2nd period.
Learning outcomes:
Learning outocomes:
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,mine visit.
Assessment methods and criteria:
Exam.
Person responsible:
D.Sc. (Tech.) Pekka Särkkä

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

Opintokohteen kielet: Finnish

Learning outcomes:
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.

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.

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

Language of instruction:
Finnish
Learning outcomes:
Separation processes are usually the most 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. Homework assignments affect the course grade. Examination.
Recommended optional programme components:
Courses Momentum Transfer 477301A, Heat Transfer 477302A and Mass Transfer 477303A recommended beforehand.
Recommended or required reading:
King, C.J.: Separation Processes, McGraw-Hill, 1980, 850 pp.; Noble, R.D. & Terry, P.A.: Principles of Chemical Separations with Environmental Applications. Cambridge 2004, Cambridge University Press, 321 pp.
Additional literature: Henley, E.S. & Seader, J.D.: Equilibrium Stage Separation Operations in Chemical Engineering, John Wiley & Sons, 1981, 742 pp.; McCabe, W.L. et al.: Unit Operations of Chemical Engineering, 5th ed., McGraw-Hill, 1993, 1130 pp.; Rousseau, R.W.: Handbook of Separation Process Technology, John Wiley & Sons, 1987, 1010 pp.
Person responsible:
Professor Riitta Keiski

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

477408S: Slags and Slag Formation in Pyrometallurgy, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pekka Tanskanen

Opintokohteen kielet: Finnish

Leikkaavuudet:

470617S Refractory Materials in Pyrometallurgical Processes 3.0 op

ECTS Credits:
5 cr
Language of instruction:
Finnish
Timing:
Implementation in 3rd period.
Learning outcomes:
The student understands the properties and behaviour of slags in high temperature processes, especially in metallurgy. It should however be noted that this course is not organised in English and it is impossible to pass it in any other language besides Finnish. Therefore there are no requirements for the non-Finnish-speaking students.
Learning outcomes *:* Student can explain the structures, properties and relevance of pyrometallurgical slags in high temperature processes. Additionally, (s)he can estimate the relations between process conditions and slag formation based on the structure and properties of the slags.

Contents:
Slags' chemical and physical properties, formation and tasks in different high temperature processes. As applications manufacturing processes of iron and steel.
Learning activities and teaching methods:
Contact teaching and exam during the 3 rd period. Please not the course is not organised for the English speaking students.
Recommended optional programme components:
Passing the course Structure of solid materials or equal knowledge. Sufficient knowledge about thermodynamics and mass and heat transfer
Recommended or required reading:
Material used during the course.
Supplementary l iterary material **:** T o the appropriate extent of Heikkinen, E-P.: Metallurgin hyvä tietää, moniste 58: Pyrometallurgisten prosessien teoria (in Finnish). Other possible materials will be announched during the course.
Person responsible:
University teacher Pekka Tanskanen

477604S: Software and Calculation Tools in Control Engineering, 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:
Introduction to design and analysis software in automation.
Learning outcomes *:* The student can use software tools for system analysis and control design. The student can autonomously: build models for linear dynamic delayed systems, design PID controllers for them, and assess the closed loop behaviour.
Contents:
Modelling of continuous and discrete systems, Simulation of continuous and discrete systems, Systems analysis, Design of feedback control systems, Identification, Monitoring and control software.
Learning activities and teaching methods:
The course includes exercises with MATLAB. The course concludes in a written exam or skill tests.
Recommended or required reading:
Lecture handout
Person responsible:
University teacher Manne Tervaskanto

555323S: Sourcing 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

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.

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

Language of instruction:

Finnish
Learning outcomes:
Students passing the cource can describe the structure of solid materials (metals, minerals), and the interdependency of the structure and properties of the matrials. The student can compare and classify materials and tell the factors the clasification is based on. Additionally, the student can tell about the importance of the structural approach on the materials when estimating their performance in use or in reprosessing. It should however be noted that this course is not organised in English and it is impossible to pass it in any other language besides Finnish. Therefore there are no requirements for the non-Finnish-speaking students.
Contents:
Structure of solid metals and oxides. How the structutre effects on the properties and reactivity of the materials. Application examples: structural materials of high temperature processes and their properties, selection criteria and destroying mechanismsa nd solid inorganic materials acting as raw materials, burden materials and products and fundamantals of high temperature corrosion.
Learning activities and teaching methods:
Contact teaching and exam during the 6 th period. Please not the course is not organised for the English speaking students.
Recommended or required reading:
Material used during the course.

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:
Learning outcomes: The course introduces students to surface phenomena of physical chemistry. After eprforming the course, student can evaluate mineral technical processes and unit operations on basis of physical chemistry.
Person responsible:
D.Sc. (Tech.) Jaakko Rämö

477405S: Surfaces and Phase Boundaries in Pyrometallurgy, 4 op

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:

470613S	Physical Chemistry of Pyrometallurgical Processes	10.0 op

Voidaan suorittaa useasti: Kyllä

Language of instruction:
Finnish
Learning outcomes:
The student will understand the properties of different phases and the interphases (gas-solid, gas-liquid, solid-solid, solid-liquid, liquid-liquid) in the high temperature processes. It should however be noted that this course is not organised in English and it is impossible to pass it in any other language besides Finnish. Therefore there are no requirements for the non-Finnish-speaking students.
Learning outcomes: Student can explain the essential properties of the phases as well as phase boundaries and interfaces and recognizes their relevance in pyrometallurgical processes. Additionally, (s)he can evaluate the interfacial properties (e.g. wetting, interfacial tension, surface tension) based on their definitions and computational methods as well as estimate the relations between interfacial phenomena and process conditions.

Contents:
Properties of gas, molten and solid phases. The basics of surface chemistry. Especially the structure of solid and molten metals and slags and the effect of different phase interphases in high temperature phenomena.
Learning activities and teaching methods:
Lectures and exam in Finnish during the 5 th period. Please note that the course is not organised for the English speaking students.
Recommended optional programme components:
Education of thermodynamics and transport phenomena that are included in the B.Sc. -studies of the process engineering curriculum. Structure of solid materials.
Recommended or required reading:
Material used during the course. Supplementary literary material: T o the appropriate extent of Heikkinen, E-P.: Metallurgin hyvä tietää, moniste 58: Pyrometallurgisten prosessien teoria (in Finnish). Other possible materials will be announched during the course

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

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.

773316A: Technical Properties of Sediments, 8 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Geosciences
Arvostelu: 1 - 5, pass, fail
Opettajat: Tiina Eskola
Opintokohteen kielet: Finnish

ECTS Credits:
8 credits
Language of instruction:
finnish
Timing:
2nd or 3rd year
Learning outcomes:
Upon completion of the course, student should have acquired knowledge of specify the physical and geotechnical qualities of sediments.
Contents:
Introduction to different boring methods; taking samples of fine-grained sediments. Laboratory work: defining consistency and structure of different sediments; defining different mechanical and thermal properties of sediments.
Learning activities and teaching methods:
45 h demonstrations, 135 h practical exercises, written report
Recommended optional programme components:
Exogenic processes (771109P), Field course in surficial geology (773302A), Surficial geology of Finland (773306A)
Recommended or required reading:
A handout. Velde, B: Introduction to Clay Minerals, Chemistry, Origins, Uses and Environmental Significance. Chapman & Hall, London, 198 pages. Rantamäki, Jääskeläinen & Tammirinne: Geotekniikka. pp. 31-161, 249-274, Otakustantamo, 1984.
Assessment methods and criteria:
written reports and an examination
Grading:
1-5/fail
Person responsible:
T. Eskola and K. Holappa

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 recourses; 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 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.

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:

555265P Occupational Safety and Health Management 5.0 op

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.

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:
The goal is to understand the fundamentals of thermodynamics in order to be able to consider thermodynamic equilibria in industrial processes. It should however be noted that this course is not organised in English and it is impossible to pass it in any other language besides Finnish. Therefore there are no requirements for the non-Finnish-speaking students.
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 reaction analysis, planning and control. Additionally, (s)he can define a meaningful system to be considered in computation thermodynamics; i.e. (s)he can create a computationally solvable problem based on technical problem that in itself is not solvable computationally.
Contents:
Concepts of entalphy, entropy and Gibbs free energy. 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:

The course is lectured in Finnish during the 2 nd period during which the students are required to make a portfolio consisting of a learning diary and exercices. Please note that the course is not organised for the English speaking students.

Recommended optional programme components:

Kemian perusteet and Material and Energy Balances.

Recommended or required reading:

Material used during the course.

Supplementary literary material: Atkins' Physical Chemistry (some parts).

Person responsible:

University teacher Eetu-Pekka Heikkinen

477404S: Thermodynamics of Hydrometallurgical Solutions, 3 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

Leikkaavuudet:

470612A Metallurgical Thermodynamics 7.0 op

Language of instruction:

Finnish

Learning outcomes:

To give students an ability to use computational thermodynamics, phase diagrams and solution models in the consideration of hydrometallurgical processes. It should however be noted that this course is not organised in English and it is impossible to pass it in any other language besides Finnish. Therefore there are no requirements for the non-Finnish-speaking students.

Learning outcomes : Student can examine hydrometallurgical systems including non-ideal solutions using computational thermodynamics, solution models (e.g. Debye-Hückel) and phase diagrams. In addition to actual computational determination of chemical equilibria, student should be able to recognize the role of thermodynamics among the other tools that can be used in process engineering and extractive metallurgy. Finally, (s)he should be able to create computationally solvable problems based on technical problems that in themselves are not solvable computationally as well as interpret and evaluate the computational results from the perspective of the original problem.

Contents:

Fundamentals of hydrometallurgical processes. Solution models that are relevant in the consideration of hyrometallurgical solutions. Phase diagrams. Use of CTD in hydrometallurgy. Fundamentals of corrosion.

Learning activities and teaching methods:

The course is lectured in Finnish during the 3 rd period during which the students are required to make a portfolio consisting of a learning diary and exercices. Please note that the course is not organised for the English speaking students.

Recommended optional programme components:

Education of thermodynamics that is included in the B.Sc. -studies of the process engineering curriculum.

Recommended or required reading:

Material used during the course.

Supplementary literary material: Fletcher, P.: Chemical Thermodynamics for Earth Scientists; Pitzer, K. S., Breewer, L.: Thermodynamics.

Person responsible:

University teacher Eetu-Pekka Heikkinen

477403S: Thermodynamics of Pyrometallurgical Solutions, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Eetu-Pekka Heikkinen

Opintokohteen kielet: Finnish

Leikkaavuudet:

470612A Metallurgical Thermodynamics 7.0 op

Language of instruction:
Finnish
Learning outcomes:
To give students an ability to use computational thermodynamics, phase diagrams and solution models in the consideration of pyrometallurgical processes. It should however be noted that this course is not organised in English and it is impossible to pass it in any other language besides Finnish. Therefore there are no requirements for the non-Finnish-speaking students.
Learning outcomes *:* Student can examine pyrometallurgical systems including non-ideal solutions using computational thermodynamics, solution models (e.g. WLE-formalism) and phase diagrams. In addition to actual computational determination of chemical equilibria, student should be able to recognize the role of thermodynamics among the other tools that can be used in process engineering and extractive metallurgy. Finally, (s)he should be able to create computationally solvable problems based on technical problems that in themselves are not solvable computationally as well as interpret and evaluate the computational results from the perspective of the original problem.
Contents:
Standard states and solution models that are relevant in the consideration of pyrometallurgical solutions. Phase diagrams. Use of CTD in pyrometallurgy.
Learning activities and teaching methods:
The course is lectured in Finnish during the 1 st period during which the students are required to make a portfolio consisting of a learning diary and exercices. Please note that the course is not organised for the English speaking students.
Recommended optional programme components:
Education of thermodynamics that is included in the B.Sc. -studies of the process engineering curriculum.
Recommended or required reading:
Material used during the course.
Supplementary literary material: Gaskell, D.R.: Introduction to Metallurgical Thermodynamics; Biswas, A. K., Bashforth, G.R.: The Physical Chemistry of Iron and Steel Manufacture; Fletcher, P.: Chemical Thermodynamics for Earth Scientists.

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.

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 Assesment 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: Pekka Rossi, Jarmo Sallanko

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.
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. RIL 124-1.2003: Vesihuolto I (ISBN 951-758-503-3), RIL 124-2.2004: Vesihuolto II (ISBN951-758-438-5), Water distribution systems handbook. 2000 (ISBN 0-07-134213-3).
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. Soveltuvin 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 (ISBN0-07-141872-5); 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 oppimateriaali:

Sjöström, Eero , , 1981

Opintokohteen kielet: Finnish

ECTS Credits:
3 credits
Language of instruction:
Finnish/English on demand.
Timing:
4th or 5th autumn or spring. The course is lectured every other year.
Learning outcomes:
At the end of the course, the students should have acquired an understanding of 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, one final examination.
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.
Person responsible:
Prof. O. Hormi