

Catalogue report

LUT School of Energy Systems

Master's Programme in Welded Metal Structures

Master's Programme in Welded Metal Structures 2017-2018 (120 ECTS cr)

Facts

- Degree Master of Science in Technology (M.Sc. Tech.), (Diplomi-insinööri in Finnish)
- Higher university degree, gives eligibility to apply for scientific doctoral studies
- Extent 120 ECTS credits
- Duration two years, full-time studies of 60 ECTS per academic year.

Learning Outcomes of the MSc Programme in Welded Metal Structures

After completing Master's Programme in Welded Metal Structures a student will learn about the design, analysis, fabrication and research of modern and competitive welded metal structures. A student will acquire a good understanding about the strength and ductility properties of metallic materials and their behaviour under long-term loading together with their weldability aspects. This will provide competencies to design different types of metal structures such as machine bodies, bridges, buildings, structural components and bodies for vehicles or supporting structures for different types of engineering applications.

A student will

- be able to demonstrate a comprehensive understanding of design and fabrication of welded metal structures for demanding applications
- have adopted principles of fatigue failure analysis of welded metal structures and metallurgical theories describing the behavior of metallic materials due to different welding processes
- have adopted the principles of innovative and critical thinking and purposeful problems solving
- be able to work with others in task-orientated groups and participate and interact in the group in a productive manner and lead and manage design projects
- be able to logically think through theoretical and practical problems and solve it
- be able to contribute to innovative thinking to improve the properties and lifetime expectations of welded metal structures

Degree Structure

The Master's degree (120 ECTS) consists of core studies, specialisation studies, minor studies and free elective studies. The Master's Thesis and Seminar is included in the specialisation studies.

See Uni-portal:

[Welded Metal Structures](#)

Degree structures

Degree Structure

The Master's degree (120 ECTS) consists of core studies, specialisation studies, minor studies and free elective studies. The Master's Thesis and Seminar is included in the specialisation studies, and the Thesis must be written in English in the programmes taught in English.

Students may choose any minor offered by LUT (check the required prerequisites, if any) or do the minor during exchange abroad (upon application).

Minors of Mechanical Engineering are:

KoDSaManu Modern Manufacturing

KoDSaLaser Advanced Digital Laser Based Photonic Production

KoDSaMate ssAdvanced Materials Engineering and

KoDSaSusta Sustainability

Please notice that the extent of the minors of Mechanical Engineering is 25 ECTS cr.

Free elective studies can be any courses offered by LUT if the required prerequisites are fulfilled. Studies in other universities/from abroad or a max. of 10 ECTS of internship (BK10A1400 Work Internship in Master's Degree, 2-10 ECTS) may be included upon application, too. Language studies are recommended, especially English courses and Finnish courses for international students.

See the degree structure for details.

Master's Programme in Welded Metal Structures 2017-2018 (muok. 29.6.2017)

Degree structure status: published

Academic year: 2017-18

Beginning date of the academic year: 01.08.2017

Core Studies (min 34 cp)

KoDCore: Core Studies, 30 - 40 cp

Obligatory Studies 34-35 ECTS cr

BK10A1200: Research Methods and Methodologies, 4 cp

BK10A3800: Principles of Industrial Manufacturing Processes, 5 cp

BK10A3900: Reliability Based Machine Element Design, 5 cp

BK10A4000: Design of Advanced Plate and Shell Structures, 5 cp

BK10A4100: Management and Leadership Skills in Mechanical Engineering, 5 cp

BK50A2701: Selection Criteria of Structural Material, 5 cp

BK70A0001: Simulation of a Mechatronic Machine, 5 cp

Only for students coming outside LUT

BK10A0300: Introduction to M.Sc. Studies, 1 cp

Specialisation Studies (min 55 cp)

KoDWelde: Welded Metal Structures, 30 - 50 cp

Obligatory Studies 40 ECTS cr

BK10A1501: Master's Thesis and Seminar, 30 cp

BK80A3000: Integrated Design and Fabrication of Welded Structures, 5 cp

BK80A3100: Scientific Research of Welding and Structures, 5 cp

Choose either module Advanced Structural Design or module Sustainable Welding Production

KoDWelde150: Advanced Structural Design, 10 - 30 cp

Choose at least 15 ECTS cr from the following courses

BK20A2400: Materials and Welding Metallurgy, 5 cp

BK80A1302: Applications for FE-method for Steel Structures, 5 cp

BK80A1402: Fatigue Design, 5 cp

BK80A2303: Steel Structures II, 5 cp

KoDWelde160: Sustainable Welding Production, 10 - 30 cp

Choose at least 15 ECTS cr from the following courses

BK20A0403: Modern Welding Processes, 5 cp

BK20A2400: Materials and Welding Metallurgy, 5 cp

BK20A2500: Sustainable Welding Production, 5 cp

BK20A2600: Modelling and Simulation in Welding, 5 cp

Minor Studies (min 20 cp)

Students may choose any minor studies taught at LUT if the required prerequisites are fulfilled. Minor studies of Mechanical Engineering are Modern Manufacturing (code KoDSaManu), Advanced Digital Laser Based Photonic Production (KoDSaLaser), Advanced Materials Engineering (KoDSaMate) and Sustainability (KoDSaSusta).

Free Elective Studies

Choose enough free elective studies to attain the full 120 ECTS cr. Free elective studies can include any courses offered by LUT if the required prerequisites are fulfilled. Students are recommended to include an internship that improves professional skills to elective studies. An internship may be worth a maximum of 10 ECTS credits. More information: BK10A1400 Work Internship in Master's Degree 2-10 ECTS cr. Also language studies are recommended, especially English courses and Finnish courses for international students.

Courses and study modules not included in degree structures

Minor Studies

The extent of the minor is a min. of 20 ECTS. Students may choose any minor offered by LUT (check the required prerequisites, if any) or do the minor during exchange abroad (upon application).

Minors of Mechanical Engineering are:

KoDSaManu Modern Manufacturing

KoDSaLaser Advanced Digital Laser Based Photonic Production

KoDSaMate Advanced Materials Engineering and

KoDSaSusta Sustainability

Please notice that the extent of the minors of Mechanical Engineering is 25 ECTS cr.

Other minors taught at LUT in the academic year 2017-2018 are:

Energy Technology:

EnSaM100 Energiatekniikka (in Finnish)

EnSaM150 Energiatekniikka, laaja (in Finnish)

EnDSaBT Bio-Energy Technology

EnDMES Modelling of Energy Systems

Environmental Technology:

YmKSaYmte Ympäristötekniikka (in Finnish)

YmDSaResp Environmental Responsibility

Electrical Engineering:

SaSaM100 Sähkötekniikka (in Finnish)

SaSaM101 Sähkötekniikka, laaja (in Finnish)

SaDSaIE Industrial Embedded Systems

SaDREE Renewable Energy and Energy Efficiency

SaDSaEDM2 Power Electronics and Electrical Drives

Industrial Engineering and Management:

TuKSOTekn Tuotantotalous, sivuopinnot muu tekniikka (in Finnish)

TuDSO Tuotantotalous, sivuopinnot laaja (in Finnish)

TuSOYritt Yrittäjyys, sivuopinnot (in Finnish)

TuSOEntr Entrepreneurship, minor

TuSOMBAN Business Analytics

Computer Science:

TikSOTite Tietotekniikka (in Finnish)

TiDSOSE Software Engineering (extensive)

Business Administration:

KaSOLiik Liiketoimintaoaaminen (in Finnish)

KaSOIbm International Business and Management.

Computational Engineering:

MaKSaM180 Teknillinen matematiikka (in Finnish)

FyKSaM110 Teknillinen fysiikka (in Finnish)

MaKSaM190 Älykäs laskenta (in Finnish)

MaDIntM300 Technomathematics

FyDInt300 Technical Physics

MaDSaM300 Intelligent Computing

Chemical and Process Engineering:

KeSoM200 Kemia (in Finnish)

KeSoM300 Kemian prosessitekniikka (in Finnish)

KoDSaLaser: Advanced Digital Laser Based Photonic Production, 20 - 30 cp

Obligatory Studies 25 ECTS cr

BK30A0803: Digital Advanced Manufacturing with Lasers, 5 cp

BK30A0901: Additive Manufacturing - 3D Printing, 5 cp

BK30A1201: Laser Materials Processing, 5 cp

BK30A1300: Laser Based Manufacturing for Design, 5 cp

BK30A1400: Individual Project Work of Laser Technology, 5 cp

KoDSaMate: Advanced Materials Engineering, 20 - 30 cp

Obligatory Studies 25 ECTS cr

BK90C1900: Introduction to Materials Engineering, 4 cp

BK90C2000: Hybrid Materials, 3 cp

BK90C2100: Functional Properties of Nanomaterials, 3 cp

BK90C2200: Sustainable Manufacturing of Advanced Materials, 5 cp

BK90C2300: High Performance Products, 5 cp

BK90C2400: Project course in Material Engineering, 5 cp

KoDSaManu: Modern Manufacturing, 20 - 30 cp

Obligatory Studies 25 ECTS cr

BK50A4000: Production Processes in Modern Job Shops, 5 cp

BK50A4100: Manufacturing Systems and Scheduling, 5 cp

BK50A4200: Product Flow in Job Shops, 5 cp

BK50A4300: Managing Job Shops, 5 cp

BK50A4401: Fabrication Laboratory, 5 - 10 cp

KoDSaSusta: Sustainability, 20 - 30 cp

Obligatory Studies 24-27 ECTS cr

BH60A2101: Advanced Course in Life Cycle Assessment, 7 cp

BJ02A4051: Development of New Sustainable Products and Solutions, 5 cp

CS30A1691: Social Sustainability, 6 cp

CT10A7002: Green IT and Sustainable Computing, 6 cp

Students, who haven't done BH60A0000 Ympäristötekniikan perusteet in their earlier studies, are required to do Introduction to Sustainability.

BH60A4400: Introduction to Sustainability, 3 cp

Course descriptions

Descriptions of courses and study modules included in the degree structures

KoDCore: Core Studies, 30 - 40 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Study module

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

No course descriptions.

Obligatory Studies 34-35 ECTS cr

BK10A1200: Research Methods and Methodologies, 4 cp

Validity: 01.08.2012 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Harri Eskelinen

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Docent, D.Sc. (Tech.) Harri Eskelinen

Aims:

After having passed this course module the student is able to:

- plan, lead and organize the research project according to the established scientific practices and procedures
- compare, choose and utilize proper scientific practices to carry out research projects in industrial environments
- write and present a scientific research plan and research report.

Contents:

Learning outcomes: Criteria to evaluate the scientific contribution of research. Scientific research projects in engineering science. Principles of qualitative and quantitative analysis. Viewpoints on how to illustrate the results of quantitative analysis. Different means to carry out literature reviews, interviews and surveys. Utilisation of silent knowledge. Contents and structures of research plans and research structures based on the IMRAD principle. Viewpoints of writing scientific articles and conference papers. Practical advice about giving a conference presentation. Guidelines for acting as an opponent in a scientific conference or seminar.

Teaching Methods:

Lectures and discussions 14 h, 1st period. Individual guidance and exercises 14 h, 1st period. Independent study and literature search 28 h, 1st-2nd period. Written research plan 48 h, 2nd period. Total workload 104 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, continuous and comprehensive evaluation

Course Materials:

Lectures in the Moodle. For Finnish students: Eskelinen & Karsikas, Tutkimusmetodiikan perusteet - Tekniikan alan oppikirja, Tammertekniikka, 2014.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

BK10A3800: Principles of Industrial Manufacturing Processes, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Juho Ratava, Juha Varis

Note:

uusi opintojakso

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Postdoctoral Reseacher, D.Sc. (Tech.) Juho Ratava

Aims:

After having completed this course module the student should be able to describe the principles of machining products and production, sheet metal production and products, generally used welding processes, extrusion process, packaging processes, characteristics describing manufacturability aspects of different materials and quality measurement. The student will be able to write technical and scientific text, as well as search for scientific information, evaluate it critically and use it in their report.

Contents:

The course focuses on the most typical and used processes in manufacturing technology, subtitles informed detailed in "Aims". The course runs through the various processes having a strong connection to product design. The Design for Manufacturing will be pointed out.

Teaching Methods:

Lectures 21 h

Seminar lecture 3h, period 1

Seminars 4 h, period 2

Seminar work (pair work) and working as an opponent 90 h

Industrial visit 12 h, period 2

Total workload 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

0-5, exam 40 %, seminar 60 %

Intermediate seminar presentation, final presentation and working as opponent. Participation in industrial visit and seminar

Course Materials:

Course material is available on the Moodle.

Places for exchange-students? (Yes, number/No):

Yes, 10

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

BK10A3900: Reliability Based Machine Element Design, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Kimmo Kerkkänen, Harri Eskelinen

Note:

Uusi kurssi

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Docent, D.Sc. (Tech.) Harri Eskelinen

University Lecturer, D.Sc. (Tech.) Kimmo Kerkkänen

Aims:

After having passed this course, the student will be able to:

- utilize two reliability measures: safety index and probability of failure
- apply tools and techniques for risk analysis of a machine or mechanical system
- use principles, with which the designer can improve the geometries, shapes, sizes, material properties, and topology of a product to reduce the failure probability
- utilize statistical information to support reliability design
- apply failure mode analysis, especially in context of wear and corrosion phenomena
- choose an appropriate distribution to analyze reliability aspects of a component

Contents:

The importance of multidisciplinary optimization including reliability-based constraints in design is discussed. Two significant reliability measures, safety index and probability of failure, are compared and discussed. Tools and techniques for both qualitative and quantitative risk analysis of an assembly or any technical system are presented. Principles, with which the designer can modify the geometries, shapes, sizes, material properties, and topology of a product to reduce the failure probability are discussed. Possibilities to utilize statistical information to support reliability design are evaluated. Aspects, how uncertainties associated with statistical distributions and any insufficient information may lead to large errors in probability calculations in engineering, are clarified. Tools for analyzing failure modes of machine elements, machines and technical systems especially in context of wear and corrosion phenomena, are taught. Guidelines to choose an appropriate distribution to analyze reliability aspects and lifetime of a component are presented.

Teaching Methods:

Lectures total 28 h, periods 1 - 2. Literature search 20 h, periods 1 - 2. Team and project work 74 h, periods 1 - 2. Seminar 8 h, period 2. Total workload 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, team and project work 70 %, seminar 30 %.

Course Materials:

Patrick O'Connor, Andre Kleyner, Practical Reliability Engineering, 5th Edition, 978-0-470-97982-2. Erdman, A.G., Mechanism Design. Norton, R.L., Design of Machinery. Lectures in Moodle

Prerequisites:

B.Sc. (Tech.) Degree or equivalent knowledge

Places for exchange-students? (Yes, number/No):

Yes, 5

Places for Open University Students?(Yes, number/No):

No

Related to:

to sustainability

BK10A4000: Design of Advanced Plate and Shell Structures, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Timo Björk, Ilkka Pöllänen

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Ilkka Pöllänen, M.Sc. (Tech.)

Timo Björk, D.Sc. (Tech.), Professor

Aims:

After having passed this course module the student is able to:

- recognize different type of plate and shell structures and their application in mechanical engineering
- understand the behavior of plates and shells in term of strength and capacity and can design simple structures and analyze fabrication processes
- choose purposeful solution in terms of design, fabrication and material (steels, other metals and composites) for certain application and can design simple constructions
- design the fabrication such as bending, forming and cutting of plate as a workshop processes
- understand and utilize the capability of FEA in design and fabrication on plate and shell structures
- design and fabrication of cell structures (laser, 2D-printing and extruding-processes)

Contents:

During the course the student will become familiar with:

- the basic theory of plate and shell structures
- design of plate and shell structures considering stiffness, vibrations, stability and simple plastic limit state
- simulation of fabrication, such as brake pressing, mechanical cutting and punching of plate

- fabrication possibilities of plate and shell structures
- laboratory tests of plate and shell structures to compare the results with analytical and FEA.

Teaching Methods:

Lectures 42 h, laboratory work 4 h, guided exercises 14 h, exercises and home works individually and in groups 70 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, Exercises (40 %), examination (60 %).

Course Materials:

Lectures on Moodle.

Prerequisites:

Book recommendation: Benham, Crawford & Armstrong, Mechanics of Engineering Materials. Recommended BK80A2701 Ljuusoppi

Limitation for students? (Yes, number, priorities/Leave empty):

Yes

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

BK10A4100: Management and Leadership Skills in Mechanical Engineering, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Kimmo Kerkkänen, Harri Eskelinen, Tapio Saarelainen

Year:

M.Sc. (Tech.) 1

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

Docent, Ph.D. (Mil.), Tapio Saarelainen
University Lecturer, D.Sc. (Tech.) Kimmo Kerkkänen
Docent, D.Sc. (Tech.) Harri Eskelinen

Aims:

After having passed this course, focusing on engineering tasks, the students will be able to:

- utilize basics of effective delegation and meeting management also in a networking environment
- employ effective communication techniques and apply both social and leadership skills to optimize end results and to manage possible conflicts in contexts of teamwork or projects
- set and achieve goals for the set work and projects and lead themselves
- identify opportunities to enhance cooperation among their colleagues
- manage day-to-day challenges of leading a team and manage time and prioritize work
- use effective strategies for organizing projects and negotiating resources
- apply problem-solving and decision-making skills to accomplish tasks
- assess their flexibility and openness to new ideas to inspire other team members and to create and sustain a positive, productive atmosphere
- create and implement changes as applicable to lead team work or projects
- understand the role of financial and business management in engineering projects.

Contents:

This course introduces fundamentals of leadership and management as regards contexts of engineering projects. The students gain experience in project work, develop team work skills, apply self-management and implement work discipline. Through interactive activities, self-assessments, discussions, and practical team and project work, the students learn how to lead either product design tasks, production or larger scale projects with the focus on the field of mechanical engineering in particular. The skills introduced include communicating effectively, solving problems, making decisions, working in teams, building relationships, creating and implementing changes in an organization, and aligning one's goals with the organization's mission, goals, and objectives. Depending on the given task within the course module, the students are advised to recognize the special skills and competences needed for leading design tasks, production or larger scale projects.

Teaching Methods:

Lectures and literature review 8 h, period 1, orientation meetings 6 h, period 2 and group discussions 10 h, periods 2-4. Participation in the board meetings of virtual companies 24 h, periods 1-4. Building of a networking environment for the teamwork and project management 10 h, period 1. Exercises and the utilization of a leadership journal to get practical experience in working as a project manager, production manager, design manager, workshop manager, engineering team leader etc. 72 h, periods 1-4. Total workload 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, continuous and comprehensive evaluation of success in teamwork and project work, peer review of management and leadership skills and the evaluation of a leadership journal.

Course Materials:

Lecture notes, books and articles used for the literature review.

Prerequisites:

B.Sc. (Tech.) Degree or equivalent knowledge

Places for exchange-students? (Yes, number/No):

Yes, 5

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

BK50A2701: Selection Criteria of Structural Material, 5 cp**Validity:** 01.08.2016 -**Form of study:** Basic studies**Type:** Course**Unit:** LUT School of Energy Systems**Grading:** Study modules 0-5,P/F**Teachers:** Jörg Wunderlich, Sari Pärssinen, Harri Eskelinen**Note:**

Replaces the course BK50A2700 Selection Criteria of Structural Material.

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Docent, D.Sc. (Tech.) Harri Eskelinen

Aims:

After having passed this course module the student is able to:

- apply and develop systematic and analytical means and tools of systematic material selection approaches into solving cross-technological material selection tasks
- define and analyse the properties, the strengths, the weaknesses and the application areas of the main groups of constructional materials for different types of applications
- is able to justify and build generalized models to take into a count both the functionality and the manufacturability aspects in addition to the total costs and environmental aspects of the product in solving the material selection task
- is able to evaluate and utilize recent results and documents of material science
- derive analytical models based on the principles of LCC's, LCA's and MIPS-factors in material selection.

Contents:

During the course the student will become familiar with the properties and application areas of different constructional materials. The recent scientific results dealing with material science and technology will be discussed. Aspects of selecting and comparing different materials are discussed from the viewpoints of functionality, manufacturing aspects, costs and environmental aspects of the product. Future trends in materials science are discussed briefly. Metals and their alloys, polymers, ceramics, composites, wood materials, adaptive materials, nanomaterials. Environmental aspects of material selection from the viewpoint of LCC and LCA and the basics of MIPS calculations. Innovative solutions of the material selection tasks will be discussed. Principles to formulate and solve the materials solution tasks based on analytical and systematic approaches and means to develop models to support the selection process starting from the product's requirement list will be discussed in details. Multi-language teaching environment will be utilized during the project work.

Teaching Methods:

Lectures 14 h, 1st period. Lectures 14 h, 2nd period. Exercises in small teams 28 h, 1st-2nd period. Project work and poster presentation 54 h, 1st-2nd period. Independent study 20 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, comprehensive and continuous evaluation

Course Materials:

Mangohon, P., The Principles of Materials Selection for Engineering Design. Strong, A. B., Plastics, Materials and Processing. Kalpakjian, S. & Schmid, S., Manufacturing Engineering and Technology. Lectures and exercises in Moodle. For Finnish students: Eskelinen & Karsikas, Vihreän teknologian näkökulmat konstruktiomateriaalien valinnassa, ISBN 978-952-265-457-1.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

Related to:

to sustainability

BK70A0001: Simulation of a Mechatronic Machine, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Aki Mikkola

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Aki Mikkola

Aims:

The student possesses the theories and practices of mathematical modeling and computer simulation of machine systems, which are either hydraulically or pneumatically actuated. The student is able to utilize simulations as an integrated tool of product design and he/she can utilize his/her skills to generalize the theories of engineering design to solve multidisciplinary design tasks and real-life problems. The student is able to compare and justify the use of different constructional solutions for linear and rotating motion mechanism based on their static, kinematic and dynamic analysis. The student is able to individual scientific work to simulate mechatronic machines.

Contents:

Principles of multibody dynamics, modelling of actuators, coupled simulation. Use of the concept of virtual work. Constraint equations and Lagrangian multipliers. Inertia of rigid bodies. Modelling of hydraulic components. Numerical integration of the equation of motion. Individual utilisation of simulation software, including the principles of how to apply

previously mentioned mathematical theories to handling and solving abstract and multidisciplinary problems.

Teaching Methods:

Lectures 24 h, 1st-2nd period. Teamwork in multi-cultural working environment 30 h, 1st-2nd period. Supervised tutorials 24 h, 1st-2nd period. Independent study 52 h, 1st-2nd period. Total loading 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

Yes

Examination in Exam (Yes/No):

No

Number of mid-term examinations:

2

Assessment:

0-5, examination and two mid-term exams, examinations 60 %, simulation work 20 %, in class quizzes 10 %, homework 10 %.

Course Materials:

Lecture notes. Shabana, A. A.: Computational Dynamics, John Wiley & Sons, Inc., 1st edition, 1994. ISBN 0-471-30551-0.

Prerequisites:

Students are recommended to have completed BK80A2600 Mekaniikka and BK60A0200 Mekatroniikka.

Places for exchange-students? (Yes, number/No):

Yes, 30

Places for Open University Students?(Yes, number/No):

This course has 1-15 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

Only for students coming outside LUT

BK10A0300: Introduction to M.Sc. Studies, 1 cp

Validity: 01.08.2007 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Marja Talikka, John Bruzzo Escalante

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Doctoral Student, M.Sc. (Tech.) John Bruzzo, Information Specialist M.Sc. (Tech.) Marja Talikka

Aims:

The main objective of this course is to provide the student with the initial needed tools in order to familiarize the university philosophy and how to prepare the development of their degree. Most of the initial doubts related to evaluations, choosing a thesis topic as well as exchange and internships are covered. In practical level, the course addresses three main subjects:A) The course provides the student with basic knowledge of studying at LUT in general and particularly in their degree program. The course helps the student to plan and follow the progress of their studies at LUT with a help of a personal study plan.B) Students will learn to use different distance learning applications. Students will learn how to find electronic material from the Academic Library collections and databases.C) Students participate in team activities that allows them to gather more information on the study characteristics in the Finnish culture.

Contents:

The Orientation Days activities. Degree requirements. Planning of Master's studies. Making of the electronic personal study plan at the ePSP workshop. Use of the Moodle learning base. The Academic Library collections and databases. Team activities.

Teaching Methods:

Participation in the Orientation Days activities 15 h, period 1. Library tour 1 h, period 1. Assignments on general information about Master Studies 1h, information retrieval, library use and databases in Moodle. Information sources and information retrieval, Team work and exercises 2 h, period 1. ePSP workshop 2 h, period 1. Independent study 6 h. Total workload 27 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Pass/Fail

Course Materials:

Material given during the orientation Days, Study Guide, Information retrieval course in Moodle, the Academic Library collections and databases.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

KoDWelde: Welded Metal Structures, 30 - 50 cp

Validity: 01.08.2016 -

Form of study: Major studies

Type: Study module

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

No course descriptions.

Obligatory Studies 40 ECTS cr

BK10A1501: Master's Thesis and Seminar, 30 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Katriina Mielonen

Note:

Replaces the course BK10A1900 Diplomityö ja seminaari JEDI

Year:

M.Sc. (Tech.) 2

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

N.N.

Aims:

The Master's thesis is the final project of the Master's degree, which demonstrates the student's knowledge of a topic of scientific or societal importance in the professional field in question. Student is able to combine theory and practice: he/she can exploit theory in solving problems in scientific research. The student must demonstrate the ability to carry out the project independently and following a plan and student , can set goals for him/her self-concerning results and time schedules. The student manages extensive and versatile data acquisition knowhow.

Contents:

The Master's thesis is a research project by nature, which requires approximately 6 months of work. It is related to the student's major subject and its topic is agreed on by the supervisor and the student together. During the work, student must show capability to work independently according to defined plans and goals. Course includes seminars.

Teaching Methods:

The Master's thesis is a written report on the research work involved, presenting the stages of the work, the methods, results and explanations. Thesis includes a seminar, where are present students who are starting to write the Master's thesis and students who are about to graduate, and their supervisors. In the final stages, each student in his/her turn represents briefly their work's goals, content and results. Student must participate other seminars (listen at least 5 seminars) before starting his/her own thesis, and also have his/her own at the end of the work. Student also have to participate to one (1) layout and references exercise before the evaluation can be started.

Seminars 2 h, 1st-4th period. Layout and references exercise 1h (student have to participate when his/her thesis is almost ready), 1st, 2nd, 3rd or 4th period. Writing press release 1 h. Independent study 776 h. Total workload 780 h. Seminar listening points are valid till the student will graduate

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, Master's thesis 100%. Seminars passed; students have to attend at least 5 seminars and give their own presentation (possibility to online presentation and listening). One layout and references lecture participated. Press release Pass/fail.

Course Materials:

LUT final thesis instructions. Seminar instructions in Moodle.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

Related to:

to sustainability

BK80A3000: Integrated Design and Fabrication of Welded Structures, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Antti Salminen, Timo Björk

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Timo Björk, D.Sc. (Tech.), Professor

N.N., D.Sc. (Tech.), Professor

Antti Salminen, D.Sc. (Tech.), Professor

Aims:

After having passed this course module the student is able to:

- apply the skills comprehensively learned from previous courses for designing and production planning of welded structures or complete member of it
- apply the theoretical knowledge for practical design and fabrication of welded structure
- have skills to collect design data and use design tools to create a competitive and fabrication friendly construction based on requirements set by end-user
- design for fabrication (=considering the potential and limitations of available fabrication processes) but also understand the background of quality requirements set for fabrication
- understand the consisting of fabrication costs and design impact on them
- have encouragement to design and make fabrication plans later in industry, unprompted
- move this experience to work out the integrated design & fabrication process in practice (=in R&D and workshop)

Contents:

During the course the student will become familiar with the Design of real structure based on available load information, durability requirements and main boundary conditions given by end-user. Using of practical design tools (analytical and numerical) and optimization

approaches to design energy efficient constructions. Working as a member of group, consisting of design and fabrication experts, for the common goal. Create a fabrication plan and especially welding process specifications (WPS) for a structure or a complete member of it. Methods to take into consideration the available workshop facilities when choosing fabrication processes and evaluating fabrication costs. Practical interactive process between design and fabrication to find a compromising solution considering strength requirements and fabrication costs of critical structural details. Documentation of design and fabrication plan.

Teaching Methods:

Guiding lectures 8 h. Guided group working in teams 7 x 2h = 14 h. Design, calculation, and fabrication planning in teams 108 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Design (drawing & calculations) 40 %, fabrication plan 30 % and report 30 %.

Course Materials:

Material from previous lectures, such as steel structures, welding technology and laser processing.

Prerequisites:

BK80A2303 Steel Structures II or BK20A2500 Sustainable Welding Production Completed.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

Related to:

to sustainability

BK80A3100: Scientific Research of Welding and Structures, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Timo Björk, Antti Salminen

Year:

M.Sc. (Tech.) 2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Timo Björk, D.Sc. (Tech.), Professor
 N.N., D.Sc. (Tech.), Professor
 Antti Salminen, D.Sc. (Tech.), Professor

Aims:

After having passed this course module the student is able to:

- work out welding procedures tests and metallographic investigations
- define the quality parameters for welded joints
- plan the capacity test by experimental investigation for welded joints and components
- write a scientific article about this kind of investigation

Contents:

During the course the student will become familiar with the welding processes in practice (MAG-manual/robotic and laser) and carry out metallurgical research (micro-macro level analyses, hardness measuring, etc.). Measure geometrical and residual stresses or strains (by strain gauges and ARAMIS) and deformations & loads. Reporting the presenting the research work.

Teaching Methods:

Demo lectures 4 h. Guided group working in teams 14 x 3 h = 42 h. Writing the report 80 h. Seminar (presentation of the research work and contents of the article) 4 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Article and presentation 100 %.

Course Materials:

Book about experimental testing (recommendation will be announced later).

Prerequisites:

BK80A3000 Integrated Design and Fabrication of Welded Structures completed.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

Choose either module Advanced Structural Design or module Sustainable Welding Production

KoDWelde150: Advanced Structural Design, 10 - 30 cp

Validity: 01.08.2016 -

Form of study: Major studies

Type: Study module

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

No course descriptions.

Choose at least 15 ECTS cr from the following courses

BK20A2400: Materials and Welding Metallurgy, 5 cp**Validity:** 01.08.2016 -**Form of study:** Basic studies**Type:** Course**Unit:** LUT School of Energy Systems**Grading:** Study modules 0-5,P/F**Teachers:** Raimo Suoranta, Antti Salminen, Tommi Jokinen**Year:**

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor (tenuere track), D.Sc. (Tech.) Tommi Jokinen (change in teacher/30.6.2017)

Teacher in Charge: Lic.Sc (Tech.) Raimo Suoranta

Aims:

The aim of this course is to learn materials, observe metallic material's behavior in welding. After having passed this course, the student will have knowledge to understand materials behavior, the student will be able to predict and analyze the macro and microstructures of welded joint. The student will be able to apply the knowledge of material behavior of welding of complex applications in practice. The student will be able to differentiate and validate the method of welding of demanding materials in industrial applications. Modern teaching methods with proper guidance will be applicable.

Contents:

Welding Metallurgy principles. Weldability of metals and non-metal materials. Solidification of welds and factors imposing. Welding energy / heat input and their effect in welding. Heat treatments. Cracks and fracture phenomenon. Corrosion. Weldability tests. Metallurgical quality of weld and failure analyses. Macroscopic and microscopic examination of welded joint. Special features of different welding processes.

Teaching Methods:

Lectures 28 h. Laboratory work 14 h. Group work 42 h. Preparation and exercises 30 h. Preparation to examination 16 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, Group work report 30 %, Exercises 20 %, exam 50 %, presence of practical exercises is obligatory.

Course Materials:

Lectures, Kou S., Welding Metallurgy, 2003.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

This course has 1-10 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

BK80A1302: Applications for FE-method for Steel Structures, 5 cp**Validity:** 01.08.2017 -**Form of study:** Basic studies**Type:** Course**Unit:** LUT School of Energy Systems**Grading:** Study modules 0-5,P/F**Teachers:** Niko Tuominen, Ilkka Pöllänen, Timo Björk**Note:**

Replaces the course BK80A1301 FE-Analysis, Advanced Course 5 ECTS cr.

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Ilkka Pöllänen, M.Sc. (Tech.)Timo Björk, D.Sc. (Tech.), Professor

Aims:

After having passed this course module the student is able to:- model the typical industrial structures- choose an appropriate element type for the considered structure- choose an appropriate analysis type for the considered structure- verify the FE-analysis results by analytical computations

Contents:

During the course the student will become familiar with the:- linear analysis- vibrations of the structure- stability behaviors of the structures- non- linear analysis- sub- modelling techniques- manufacturing requirements in the FE-analysis

Teaching Methods:

Lectures 28 h, period 3rd-4th. Exercises 28 h, period 3rd-4th. Independent study 74 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, Examination 60 %, written assignment 40 %.

Course Materials:

Lectures on Moodle. Hakala M.K., Lujuusopin elementtinenetelmä. Rao S., The Finite Element Method in Engineering. Weaver W., Johnston P., Structural Dynamics by Finite Elements.

Prerequisites:

Basic theory of FE-modelling, linear algebra and matrix operations are required.
Book recommendation: Bryan J. Mac Donald, Practical stress Analysis with Finite Elements.

Limitation for students? (Yes, number, priorities/Leave empty):

Yes, 30

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

BK80A1402: Fatigue Design, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Mohammad Dabiri, Timo Björk

Note:

Replaces the course BK80A1401 Väsymiskestävyys.
Suitable also for doctoral studies.

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Mohammad Dabiri, M.Sc. (Tech.), Doctoral Student
Timo Björk, D.Sc. (Tech.), Professor

Aims:

The aim of this course is for the student to learn:

- fatigue as a material failure
- different approaches to analyze fatigue strength of components for mechanical engineering
- how to design fatigue loaded structures for demanding application
- how to avoid fatigue failure.

Contents:

Principals of design to avoid fatigue failure of mechanical engineering components and structures. Introduction to fatigue, dynamic loading of structures, deformation of structural materials, stress concentrations, introduction to fracture mechanics. Design of structures based on stress-life approach, strain life approach and linear elastic fracture mechanics. Introduction to design and to the fatigue assessment of welded joints.

Teaching Methods:

Lectures 42 h. Guided exercises 28 h. Home works individually 60 h. Total workload 130 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, exercises 40 %, examination 60 %.

Course Materials:

Lectures in Moodle

Dowling N.E., Mechanical Behavior of Materials 2nd, 3rd or 4th ed., Prentice Hall.

Stephens R. et al., Metal Fatigue in Engineering 2nd ed., John Wiley & Sons.

Hobbacher A.: Recommendations for fatigue design of welded joints and components.

Schijve J., Fatigue of Structures and Materials 2nd ed., Springer.

Prerequisites:

BK80A2701 Lujusoppi recommended

Places for exchange-students? (Yes, number/No):

Yes

Places for Open University Students?(Yes, number/No):

No

Related to:

to sustainability

Further information:

Suitable also for doctoral studies.

BK80A2303: Steel Structures II, 5 cp**Validity:** 01.08.2016 -**Form of study:** Basic studies**Type:** Course**Unit:** LUT School of Energy Systems**Grading:** Study modules 0-5,P/F**Teachers:** Timo Björk, Antti Ahola**Note:**

Replaced the course BK80A2302 Teräsrakenteet II.

Year:

M.Sc. (Tech.) 2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Timo Björk, D.Sc. (Tech.), Professor

Aims:

After completing the course students can design of welded structures for demanding applications, considering also fabrication requirement, which means they can:

- chose the purposeful analyzing method for fatigue design of welded joints
- design of the plated (welded and cold formed) structures considering stability
- design the structures and joints by using plastic limit state method
- evaluate the risk of brittle fracture, especially for arctic structures
- design of beams considering also torsion, warping, distortion, shear lag, etc..
- optimize structures, especially considering the potential of high and ultra high strength steels
- design of bolted connections

Contents:

The physical background for fatigue design of welded joints. Theoretical background and design (EC3) for buckling of plates, columns and beams. Plasticity theory of beams, frames and plates (yield line method). Numerical methods for analyzing of brittle fracture considering the material properties of welded joints. Theory of thin walled structures. Practical approach for design and multi-objective optimization on welded structures considering the global structural behavior and details and the potential of high strength materials. Failure modes of bolted joints.

Teaching Methods:

Lectures 42 h, laboratory work 4 h, guided exercises 14 h, exercises and home works individually and in groups 70 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, exercises 40 %, examination 60 %.

Course Materials:

Lectures on Moodle, Eurocode 3, Hobbacher A: fatigue design of welded joints and components.

Prerequisites:

Recommended BK80A2202 Teräsrakenteet I and BK80A2701 Lujuusoppi.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

KoDWelde160: Sustainable Welding Production, 10 - 30 cp

Validity: 01.08.2016 -

Form of study: Major studies

Type: Study module

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

No course descriptions.

Choose at least 15 ECTS cr from the following courses

BK20A0403: Modern Welding Processes, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Raimo Suoranta, Tommi Jokinen

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor (tenuere track), D.Sc. (Tech.) Tommi Jokinen (change in teacher/30.6.2017)
Responsible teacher: Lic.Sc (Tech.) Raimo Suoranta

Aims:

After having passed this course the student is able to identify and define the special features of welding in production and product design. Students have thorough knowledge of all welding processes that are used in industry. Students know operational principles of processes and understand the importance of selecting proper and economical process/processes to specified applications. Students understand the relationship between welding process, quality, cost effective production, energy saving and sustainability, when selecting proper welding process for different materials. Students have also general overview of utilizing standards like SFS-EN-ISO in welding production, and quality management, as far as they concern welding processes.

Contents:

Productivity usability, and efficiency and other parameters of major welding processes. Basics of materials weldability. Mechanization and robotization of welding processes. Basics of welded structures design. Knowledge of preparation work, cutting and beveling methods. Quality, environmental, sustainability and safety aspects in a welding workshop.

Teaching Methods:

Lectures 24 h, seminar presentations and opponent works 60 h, laboratory practice 8 h, preparation for Examination. Total workload 130 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

0-5, exam 70 %, seminar work 30 %. Exercises passed or failed.

Course Materials:

Lecture notes. Howard & Gray: Modern Welding Technology 6th edition. AWS Welding handbook, 9th edition.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

BK20A2400: Materials and Welding Metallurgy, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Raimo Suoranta, Antti Salminen, Tommi Jokinen

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor (tenuere track), D.Sc. (Tech.) Tommi Jokinen (change in teacher/30.6.2017)
Teacher in Charge: Lic.Sc (Tech.) Raimo Suoranta

Aims:

The aim of this course is to learn materials, observe metallic material's behavior in welding. After having passed this course, the student will have knowledge to understand materials behavior, the student will be able to predict and analyze the macro and microstructures of welded joint. The student will be able to apply the knowledge of material behavior of welding of complex applications in practice. The student will be able to differentiate and validate the method of welding of demanding materials in industrial applications. Modern teaching methods with proper guidance will be applicable.

Contents:

Welding Metallurgy principles. Weldability of metals and non-metal materials. Solidification of welds and factors imposing. Welding energy / heat input and their effect in welding. Heat treatments. Cracks and fracture phenomenon. Corrosion. Weldability tests. Metallurgical quality of weld and failure analyses. Macroscopic and microscopic examination of welded joint. Special features of different welding processes.

Teaching Methods:

Lectures 28 h. Laboratory work 14 h. Group work 42 h. Preparation and exercises 30 h. Preparation to examination 16 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0–5, Group work report 30 %, Exercises 20 %, exam 50 %, presence of practical exercises is obligatory.

Course Materials:

Lectures, Kou S., Welding Metallurgy, 2003.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

This course has 1-10 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

BK20A2500: Sustainable Welding Production, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Raimo Suoranta, Tommi Jokinen, Antti Salminen

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor (tenuere track), D.Sc. (Tech.) Tommi Jokinen (change in teacher/30.6.2017)

Aims:

After having passed this course the student is able to organize, develop and manage demanding projects of welding production. The student has knowledge of welding functions, productivity, economy and quality. The student will have the knowledge about welding quality management in real industry and arrange the welding quality management system in the company. The student will know how to implement welding quality and quality assurance systems (ISO 9000, EN ISO 3834, EN 1090, DNV, RMS) in production and make the audit work in the enterprise, as well as knowledge regarding Welding Procedure Qualification Record, Welding Procedure Specification WPS and Standards, NDT.

Contents:

Productivity, economy and quality in welding, production development in workshops, welding processes and working phases related to welding, mechanization and robotization, welding quality and quality factors, welding coordination, welding cost and competence, networking in welding and delivery networks, green welding, safety in welding and environmental effects.

Teaching Methods:

Guiding Lectures 24 h, Seminar Presentations and opponent works 70 h, Exercises 28 h, Preparation of Examination and Examination. Total workload 130 h

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

0-5. Exam 50 %, Seminar, and Opponent Work 50 %. Exercises will be passed or failed

Course Materials:

Lecture material. Previous courses, especially BK20A2400 Materials and Welding Metallurgy and BK20A0403 Modern Welding Processes.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

This course has 1-10 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

BK20A2600: Modelling and Simulation in Welding, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Esa Hiltunen

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor D.Sc. (Tech.) N.N., M.Sc. (Tech.) Esa Hiltunen

Aims:

After completing this course the student is able to recognize the characteristics of welding arc and heat flow as well as estimate their effect on weld pool behavior and parent metal. In addition, the student will be able to interpret the metallurgical effects in the parent metal and contraction and residual stress in welded structure. The student will be aware of modern IT Products available in

development of workshop operations. The student will be able to use simulation software to model a robot welding station, simulate its operation and make offline programming.

Contents:

Heat flow in arc and in weld pool. Cooling rate, heat conduction and temperature distribution in welds. Weld pool solidification. Metallurgical effects in the parent metal. Contraction and residual stress in welded structures. Modeling of robot welding system and simulation of robot operation. Optimization of operation cycles. Weldability of welded products and accessibility of robot tools in welding performance.

Teaching Methods:

Lectures 14 h, exercises 56 h, homeworks 28 h. Preparation for examination and examination. Total workload 130 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5. Examination 30 % and laboratory exercises 70 %.

Course Materials:

Lecture notes available in Moodle.

Number of exercise groups where enrollment is in WebOodi (Number/Leave empty):

3

Places for exchange-students? (Yes, number/No):

Yes

Places for Open University Students?(Yes, number/No):

This course has 1-10 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

Descriptions of courses and study modules not included in the degree structures

KoDSaLaser: Advanced Digital Laser Based Photonic Production, 20 - 30 cp

Validity: 01.08.2016 -

Form of study:

Type: Study module

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

No course descriptions.

Obligatory Studies 25 ECTS cr

BK30A0803: Digital Advanced Manufacturing with Lasers, 5 cp**Validity:** 01.08.2017 -**Form of study:** Basic studies**Type:** Course**Unit:** LUT School of Energy Systems**Grading:** Study modules 0-5,P/F**Teachers:** Antti Salminen, Ilkka Poutiainen**Note:**

Replaces the course BK30A0802 Laboratory Course of Laser Based Manufacturing.

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Antti Salminen

Aims:

After having passed the course, the student will:

- understand how laser beams are generated in a laser resonator and what kind of optical arrangements are required for a laser materials processing system
- be able to compare and generalize the special features of laser processing systems in production
- understand how and what kind of process monitoring equipment can be used for quality assurance.
- understand the practical aspects of laser materials processing of different materials
- have skills that are needed in the world of work.

Contents:

Knowledge on different laser equipment, resonator types, accessories and processing systems and requirements of different ways to process material with a laser beam. The principles of systems used for production. Optical components used for laser processing, safety and quality assurance. Tools for beam forming, guiding and modification. Practical use of laser processes. Participation in laser processing demonstrations.

Teaching Methods:

Lectures 28 h, 1st and 2nd period. Guided group working in teams (7x2h) 14 h. Design, execution and reporting seminar work in teams 88 h. Total work load 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Written report 60 %, oral presentation of seminar work 40 %. Volunteer learning diary.

Course Materials:

Lecture notes. Steen, W., Laser Material Processing.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

BK30A0901: Additive Manufacturing - 3D Printing, 5 cp

Validity: 01.08.2015 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Antti Salminen, Heidi Piili

Year:

M.Sc. (Tech.) 2, M.Sc. (Econ. & Bus. Adm.) 2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Antti Salminen, Researcher, D.Sc. (Tech.) Heidi Piili

Aims:

After having passed the course, the student will:

- know all of the different technologies of additive manufacturing (AM, aka 3D printing)
- be able to compare different AM processes and select suitable processes for different applications
- know the basics about product design for additive manufacturing
- be familiar with the possibilities of additive manufacturing in product development, prototyping and part manufacturing
- have the latest knowledge of additive manufacturing technologies and processes.

Contents:

Additive manufacturing (AM, aka 3D printing) processes, materials and equipment. Utilization of the potential of additive manufacturing in product design. Practical cases and applications. Future trends and potential of additive manufacturing. First-hand demonstrations on how to design parts for additive manufacturing. Practical demonstrations on manufacturing of parts with AM processes. Economic aspects of additive manufacturing.

Teaching Methods:

Lectures 28 h, periods 3-4. Tutorials 14 h, periods 3-4. Individual work 88 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

Yes

Examination in Exam (Yes/No):

No

Assessment:

Grade 0-5, written project report 80 %,, seminar 20 %. Volunteer Moodle exam 20%.

Course Materials:

Gibson, I., Rosen, D. W., Stucker, B.: Additive Manufacturing Technologies. Other study material will be listed in Moodle.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

This course has 15- places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

BK30A1201: Laser Materials Processing, 5 cp

Validity: 01.08.2017 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Antti Salminen

Note:

Replaces the course BK30A1200 Laser Based Processes for Materials Processing.

Year:

M.Sc. (Tech.) 2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Antti Salminen

Aims:

After having passed the course module the student is able:

- to compare laser materials processing processes and knows different processes special features
- identify what are the theoretical basis affecting in different processes and how they affect the possible applications based on them
- to know how to select and optimize proper process and processing procedure for different materials
- understanding how processing parameters affect the quality of the process / part
- to define what kind of lasers and laser systems can be applied in various processes and applications and how they could be applied
- is able to develop processes for different applications
- is able to work as expert to develop laser based processes for industrial applications

Contents:

- laser beam material interaction, transmission, reflection, absorption
- the features of different materials and laser beams affecting on phenomena
- the effect of laser based heating, melting, vaporization and ablation on material
- behavior of molten material and heat transfer mechanisms.
- formation of keyhole and phenomena connected
- knowledge on existing ways to process material with laser beam and the effect of laser beam material interaction on that
- knowledge on most common laser processes like laser welding, laser hybrid welding,

cutting, marking, drilling, engraving, micro processing additive manufacturing and surface treatment and the lasers and laser systems used for carrying them out

- practical cases, applications will be combined to theory

Teaching Methods:

Lectures 28 h, 3rd and 4th period. Guided team working 3x2 h. Design, execution and reporting of project work in team's 96 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

0-5, written project work report 50 %, oral seminar presentation 30 %, and voluntary exam 20 %.

Course Materials:

Steen W., Laser Material Processing. Ion, J., Laser Processing of Engineering Materials. Course material in Moodle.

Prerequisites:

BK20A1300 Laser Based Manufacturing for Design and BK20A1300 Laser Based Manufacturing for Design passed or equal level of understanding shown with oral exam.

Places for exchange-students? (Yes, number/No):

Yes, 1-3

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

BK30A1300: Laser Based Manufacturing for Design, 5 cp

Validity: 01.08.2016 - 31.12.2017

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Antti Salminen

Aims:

After having passed the course module the student:

- knows how to select and develop proper process and processing procedure for processing of different materials
- is able to compare the special features of laser processing systems in production and specify systems

accordingly

- realizes the impact and utilization of special features of the laser based processes on product design and is able to utilize these
- is able to utilize means of process monitoring to practice
- can work in tasks for developing production equipment, systems and production lines for laser based production

Contents:

This course is giving knowledge about industrial lasers and laser systems for materials processing in production and how laser processes special feature can be utilized in modern machine design. This includes various areas of technology involved:

- lasers, laser equipment, resonator types, accessories and processing systems and requirements of different ways to process material with laser beam.
- principles of utilization of potential of laser based processes in product design.
- special features of laser processing methods for product design.
- the principles of systems used for production.
- tools of beam forming, guiding and modification.
- knowledge on performance of most common laser processes like laser welding, cutting, marking, micro processing, additive manufacturing and surface treatment.
- optical components used with laser processing, safety and quality assurance.
- economical aspects and sustainability of laser materials processing.
- practical cases.

Teaching Methods:

Lectures 28 h. Guided group working in teams (5x2h), 10 h. Design, execution and reporting of project work in teams 92 h. Total workload 130 h.

Assessment:

Written report about project work 50 %, oral presentation 50 %.

Course Materials:

Course material in Moodle.

Prerequisites:

BK30A1100 Laser Technology and 3D Printing and BK30A0802 Laboratory Course of Laser Based Manufacturing. Or equivalent knowledge shown in oral exam.

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

BK30A1400: Individual Project Work of Laser Technology, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Joonas Pekkarinen, Antti Salminen

Note:

This is a self-study course so it is recommended that student full fills the prerequisites

Year:

M.Sc. (Tech.) 2

Period:

1-2 & 3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Antti Salminen, D.Sc. (Tech.) Joonas Pekkarinen

Aims:

After having passed the course module the student:

- apply comprehensively the learned skills of previous courses for laser based processes, systems and products
- understand how to perform research project in field of laser engineering / processing
- apply theoretical knowledge in practical R&D work
- have skills to collect existing data and use it for determining solutions
- know how to design and run experiments in field of laser processing
- select and design a laser system for industrial case.
- knows how to select right laser process and optimize the process for different materials
- is able to develop processes for different applications

Contents:

During the course student will become familiar with:

- basic phenomena of laser - material interaction in specific case i.e. transmission, reflection, absorption
- the features affecting on performing the experimental work to define the limitations and potential of ways to apply laser for manufacturing
- the effect of potential of laser in design and how to apply that into product and its manufacturing.
- reporting the tests carried out in an efficient effective way both in writing and orally.
- principles how to design and run a research project
- principles in writing scientific peer review publication

Teaching Methods:

Lectures 2 h. Guiding discussion with supervisor 10 h. Design, execution and reporting of project work 118 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Project plan 15 %, Written report 55 %, Oral presentation 30 %

Course Materials:

Steen W., Laser Material Processing.

Ion, J., Laser Processing of Engineering Materials. Course material in Moodle.

Prerequisites:

BK30A0802 Laser Based Manufacturing for Design or BK30A1200 Laser Based Processes for Materials Processing passed or equivalent understanding shown in oral exam.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

Validity: 01.08.2016 -

Form of study:

Type: Study module

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

No course descriptions.

Obligatory Studies 25 ECTS cr

BK90C1900: Introduction to Materials Engineering, 4 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Timo Kärki

Year:

M.Sc. (Tech.) 1-2

Period:

2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) , D.Sc. (Agr. & For.) Timo Kärki

Aims:

Aim of the course is to introduce possibilities of Material Engineering to students. Diverse possibilities of different materials is taken into consideration when optimizing the variable possibilities in Product Designing. After having completed this course, the student should be able to: understand the influence of material selection to the product design recognize the variable possibilities of different materials show creative and innovative expertise in the field of Materials Engineering

Contents:

Basics of Materials Engineering and Product Design. Principles of materials selection and introduction to materials selection procedures. Choice of fabrication techniques including case studies related to different materials. Selecting polymers and composites as raw materials: structure, properties, processing characteristics and applications for the commercially important polymers including general classes of polymers: commodity, engineering and specialty thermoplastics, thermosetting resins and rubbers. Introduction to specific metals, alloys and minerals: metallurgy, properties, applications and potentialities of metals, alloys and minerals in a wide variety of engineering environments. Wood materials. Introduction to engineering ceramics. Properties and manufacturing of carbon based materials. Recycled Materials as a raw material source.

Teaching Methods:

Lectures 21 h. Independent study 63 h. Seminar 20 h. Total workload 104 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, examination 70 %, seminar 30 %

Course Materials:

Course material in Moodle. Other literature to be announced during lectures.

Prerequisites:

-

Places for exchange-students? (Yes, number/No):

Yes, 10

Places for Open University Students?(Yes, number/No):

This course has 1-10 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

BK90C2000: Hybrid Materials, 3 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Ossi Martikka

Year:

M.Sc. (Tech.) 1-2

Period:

2

Teaching Language:

English

Teacher(s) in Charge:

Project Researcher, D.Sc. (Tech.) Ossi Martikka

Aims:

Organic-inorganic hybrids and composites have been playing a major role in research and society in recent years. This course aims to give the participants an understanding of the properties of the organic and inorganic components, preparation methods, characterisation techniques and also examples of functional hybrid materials. After having completed this course, the student should be able to: structure hybrid materials from separate raw material sources characterize hybrid materials with various testing methods can work in teams and solve problems related to hybrid materials

Contents:

Combinations of different materials. Various structures of hybrid materials. Properties of biopolymers and bionanomaterials. Different characterization methods: optical, morphological, surface, interfacial and mechanical characterization. Designing of Hybrid Materials. Performance of Hybrid Materials.

Teaching Methods:

Lectures 14 h. Exercises and individual guidance 20 h. Independent study 44 h. Total workload 78 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, oral examination in evaluation panel 40 %, exercises and seminar 50 %, weekly quizzes 10%.

Course Materials:

Course material in Moodle. Other literature to be announced during lectures.

Prerequisites:

-

Places for exchange-students? (Yes, number/No):

Yes, 10

Places for Open University Students?(Yes, number/No):

This course has 1-10 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

BK90C2100: Functional Properties of Nanomaterials, 3 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Irina Turku

Year:

M.Sc. (Tech.) 1-2

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

D.Sc. (Tech.) Irina Turku

Aims:

Aim of the course is to get students familiar to different types of nanomaterials. Manufacturing processes of nanomaterials are also highlighted. After having completed this course, the student should be able to: understand the variety of nanomaterials and have the readiness to understand the usability of nanomaterials in processes and products can work in teams and solve problems.

Contents:

What is nanoscience about? Classification of nanomaterials. Nanomaterial structures, fundamentals and properties. Carbon based nanomaterials, ceramics, "smart" polymers and bio-based nanomaterials. Analytical tools in nanoscience. Applications of nanomaterials. Synthesis of nanoscale materials. Bottom-up and top-down approaches. Safety of nanomaterials.

Teaching Methods:

Lectures 14 h. Exercises and individual guidance 20 h. Independent study 44 h. Total workload 78 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

0-5, oral examination in evaluation panel 60 %, exercises and seminar 40 %.

Course Materials:

Course material in Moodle. Other literature to be announced during lectures.

Prerequisites:

-

Places for exchange-students? (Yes, number/No):

Yes

Places for Open University Students?(Yes, number/No):

This course has 1-10 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

BK90C2200: Sustainable Manufacturing of Advanced Materials, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Marko Hyvärinen, Katriina Mielonen, Timo Kärki

Year:

M.Sc. (Tech.) 1-2

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.), D.Sc. (Agr. & For.) Timo Kärki

Aims:

Aim of the course is to demonstrate awareness of the range of modern manufacturing techniques for advanced materials and to select an appropriate manufacturing technique for a given component/use. After having completed this course, the student should be able to: apply various manufacturing methods to advanced materials processing define processing methods based on material selection can understand and identify possibilities of entrepreneurship in sustainable manufacturing.

Contents:

Introduction to processing technology and overview of manufacturing processes. Usable material forms: short fibers, non-woven mat, unidirectional, bidirectional, multi-axial and braided weaves. Fundamentals of laminate construction: ply orientation, balance and symmetry. Manufacturing methods: wet layup, prepreg layup, filament winding, automated tape layup, automated fiber placement, resin infusion, press molding and pultrusion. Matrix resins: thermoset vs. thermoplastic polymers, process temperatures, service limits, storage requirements, shelf life limits and pot life/work life. Process equipment: oven, autoclave and platen press. Extrusion, injection moulding and moulding as manufacturing methods. Coating and laminations methods in packaging solutions. Future process developments.

Teaching Methods:

Lectures 28 h. Independent study 72 h. Seminar 30 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, examination 70 %, seminar 30 %.

Course Materials:

Course material in Moodle. Other literature to be announced during lectures.

Places for exchange-students? (Yes, number/No):

Yes, 10

Places for Open University Students?(Yes, number/No):

This course has 1-10 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

BK90C2300: High Performance Products, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Timo Kärki

Year:

M.Sc. (Tech.) 1-2

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.), D.Sc. (Agr. & For.) Timo Kärki

Aims:

Aim of the course is to highlight the developments in the design of energy systems, aircraft, cars, electronic equipment, constructions, packaging, etc., which depend critically upon the availability of novel materials. Of equal importance is an understanding of both advanced processing techniques, the latest computer based design procedures and environmental aspects essential for product commercialization from the concept phase. After having completed this course, the student should be able to: define concepts and entities related to high performance products have a good understanding about product range manufactured with various methods can solve real-life problems related to high performance products.

Contents:

Composite industry overview: applications for composites, history and current technologies. Health and safety and industry terminology in high performance products. Applications in energy systems, aeronautical industry, automotive industry, marine industry, construction industry and smart materials in packaging industry.

Teaching Methods:

Lectures 28 h. Independent study 72 h. Seminar 30 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, examination 70 %, seminar 30 %.

Course Materials:

Course material in Moodle. Other literature to be announced during lectures.

Places for exchange-students? (Yes, number/No):

Yes, 10

Places for Open University Students?(Yes, number/No):

This course has 1-10 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

BK90C2400: Project course in Material Engineering, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Marko Hyvärinen

Year:

M.Sc. (Tech.) 1-2

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Laboratory Engineer, D.Sc. (Tech.) Marko Hyvärinen

Aims:

Aim of the course is to get the students familiar to the project type working in materials engineering. Typical project will start with selection of materials and manufacturing method for a certain end product. After having completed this course, the student should be able to: ability to build up material selection route from end product and manufacturing methods to raw materials ability to work in a project organisation in certain role can act and communicate in groups and networks.

Contents:

Projects are completed across the full spectrum of manufacturing, including energy systems, automotive, construction industry, packaging etc. Project titles are varied and cover areas of operational improvement, strategic decision-making and organizational management. Sub-areas for project can be following: material optimization, selection of manufacturing method, testing, production planning, scheduling and inventory optimization, capacity utilization, lead time reduction, quality improvement and control, new product development process, effective maintenance, energy usage, layout floor planning, inter-departmental effectiveness, feasibility study in to a new technology, market approval, sales, marketing and business strategy, new markets, products, company strategies, competitors and routes to market.

Teaching Methods:

Lectures 6 h, exercises and individual guidance 28 h, project work 96 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, project work 70 %, exercises 30 %.

Course Materials:

Course material in Moodle. Other literature to be announced during lectures.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

This course has 1-10 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

KoDSaManu: Modern Manufacturing, 20 - 30 cp

Validity: 01.08.2016 -

Form of study:

Type: Study module

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

No course descriptions.

Obligatory Studies 25 ECTS cr

BK50A4000: Production Processes in Modern Job Shops, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Juho Ratava, Mika Lohtander

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Researcher, D.Sc. (Tech.) Mika Lohtander

Aims:

After completing the course, the students:

1. can choose the manufacturing processes for the most common products
2. are able to design a manufacturing order for a modern product
3. are able to evaluate manufacturing time and manufacturing costs based on basic mathematics.

Contents:

The course focuses production processes, material handling and storage methods needed in modern job shops. During the course, students become familiar with the basic metal industry processes as well as manual and automatic assembly processes. Individual works allows students to familiarize themselves to different kind of manufacturing processes. Students presents case-tasks to other students.

Teaching Methods:

Lectures 24 h, lecture exercises and week works 12 h. Independent work 94 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, activity during course 33 %, learning diary 34 %, lecture exercises 33 %.

Course Materials:

Literature to be announced during lectures. Course material is available in the Moodle.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

BK50A4100: Manufacturing Systems and Scheduling, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Esko Niemi, Mika Lohtander

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Researcher, D.Sc. (Tech.) Mika Lohtander

Aims:

After completing the course, the student:

1. is able to evaluate the most important production parameters like lead time and bottlenecks by means of simulation
2. is able to design fundamentals of the manufacturing systems
3. is able to evaluate manufacturing time and manufacturing costs based on manufacturing simulation

Contents:

The course focus on production management and analysis methods needed in modern job shops. Production was analyzed by computational methods and manufacturing simulation is introduced and some case studies will analyzed. Example tasks are calculated and discussed in small groups. Every lecture includes its own exercise.

Teaching Methods:

Lectures 24 h, lecture exercise 24 h. Individual work 82 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, activity during course 50 %, individual work 50 %.

Course Materials:

Literature to be announced during lectures. Course material is available in the Moodle.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

BK50A4200: Product Flow in Job Shops, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Mika Lohtander

Lectured every other academic year (Yes, next realization year/Leave empty):

Yes, lecturing every second year, next time in period 1. and 2. in year 2018.

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Researcher, D.Sc. (Tech.) Mika Lohtander

Aims:

After having passed the course, the student will:

1. know the the factory management duty and responsibility
2. is able to take responsibility for the daily operations of a production plant
3. know the stakeholders role for production

Contents:

The course lectures will discuss the meaning of overall function of manufacturing and stakeholder's point of view. The topics cover everyday information technology, stakeholder cooperation and internal operation of the plant. A personal work will dealt more in-depth point of view to management.

Teaching Methods:

Lectures 24 h, individual work 106 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, learning diary 50 %, individual work 50 %.

Course Materials:

Literature to be announced during lectures. Course material is available in the Moodle.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

BK50A4300: Managing Job Shops, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Mika Lohtander

Note:

The course will be lectured for the first time during the academic year 2017-2018.

Lectured every other academic year (Yes, next realization year/Leave empty):

Yes, 2017-2018.

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Researcher, D.Sc. (Tech.) Mika Lohtander

Aims:

After having passed the course, the student will:

1. know the factory management duty and responsibility
2. is able to take responsibility for the daily operations of a production plant
3. know the stakeholders role for production

Contents:

The course lectures will discuss the meaning of overall function of manufacturing and stakeholder's point of view. The topics cover everyday information technology, stakeholder cooperation and internal operation of the plant. A personal work will dealt more in-depth point of view to management.

Teaching Methods:

Lectures 24 h, individual work 106 h. Total workload 130 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, learning diary 50 %, individual work 50 %.

Course Materials:

Literature to be announced during lectures. Course material is available in the Moodle.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

No

BK50A4401: Fabrication Laboratory, 5 - 10 cp

Validity: 01.08.2017 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Mika Lohtander

Note:

Replaces the course 50A4400 Fabrication Laboratory 5 ECTS cr.
Suitable also for doctoral studies.

Year:

M.Sc. (Tech.) 1-2

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

Researcher, D.Sc. (Tech.) Mika Lohtander

Aims:

After having passed the course, the student will:

1. get touch some important research topics in field of manufacturing
2. be familiar how to transfer research result to practice
3. is capable to create or build simple and practical solutions.

Contents:

The course lectures will discuss the annually changing research themes. During the course the students will built and program simple modern production equipment prototypes. Students will present their Project Work results to public audience.

Teaching Methods:

Lectures 12 h, project work 118 h. Total workload 130 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, practical part of project work 50 %, theoretical part of project work 50 %.

Course Materials:

Literature to be announced during lectures. Course material is available in the Moodle.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

Yes, this course have 1-5 places for open university students. More information on the web site for Open University instructions.

KoDSaSusta: Sustainability, 20 - 30 cp

Validity: 01.08.2016 -

Form of study:

Type: Study module

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

No course descriptions.

Obligatory Studies 24-27 ECTS cr

BH60A2101: Advanced Course in Life Cycle Assessment, 7 cp

Validity: 01.08.2010 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Risto Soukka, Sanni Väisänen, Ivan Deviatkin

Note:

Suitable also for doctoral studies.

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English/Finnish

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Risto Soukka

Aims:

Upon completion of the course the student is expected to be able to

1. explain the basic life cycle concepts,
2. plan, implement and analyse assessments to select products and services which fulfil the requirements of sustainable development,
3. plan, implement and analyse assessments to reveal development needs of products and services,
4. recognise the most inexpensive ways to reduce the environmental impact, and
5. perform life cycle assessments using software.

Contents:

Introduction to life cycle assessment, carrying out life cycle assessment, aspects related to inventory analysis, aspects related to impact assessment, calculating a carbon footprint, introduction to life cycle costing, aspects related to life cycle costing, LCA and LCC examples. This course is also suitable for postgraduate students.

Teaching Methods:

3rd period: 10 h of lectures, 3 h of computer training. Assignment 1 with a Quiz, literature and computational part, individual and pair work (approx. 38 h).

4th period: 4 h of lectures, 4 h of computer training. Assignment 2 with Life cycle modelling task, final report and result presentation meeting, group work (approx. 82 h).

Examination and preparation for it (approx. 41 h). Total workload 182 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Doctoral School course where enrollment is in WebOodi (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

Yes

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Assignments 75 %, examination 25 %.

Course Materials:

Walter Klöpffer, Birgit Grahl Life Cycle Assessment (LCA), A Guide to Best Practice. Moodle. Standards ISO 14040 and ISO 14044.

Prerequisites:

Recommended: BH60A2401 Energy Recovery from Solid Waste and BH60A0252 Solid Waste Management Technology and BH60A1600 Basic Course on Environmental Management and Economics.

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

BJ02A4051: Development of New Sustainable Products and Solutions, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Sami-Seppo Ovaska, Katriina Mielonen

Note:

Replaces the course BJ02A4050 Biomaterials Design and Application
Suitable also for doctoral studies

Year:

M.Sc. (Tech.) 1

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

D.Sc. (Tech.) Katriina Mielonen/Edited 27.6.17/ml

Aims:

To give an overview about the use of modern biochemicals such as nanocellulose, hemicellulose lignin in various applications.

After the completing the module, the student ought to:

- describe how various renewable resources is utilized in various applications.
- have an insight into material and molecular design and its role for the end product performance
- describe how biomaterials, and in particular wood derived, are used for example in food, pharmaceuticals, composites, and smart materials.

Contents:

Use of fibers, cellulose (derivatives), lignin in various non-paper applications. Fundamentals about biomaterial design, modification, synthesis and use in various products.. Chemical and mechanical modification, separation methods, mixing and drying methods. Product specification requirements and characterization methods.

Teaching Methods:

Lectures 28h Self studies 42h Project work 30h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Number of mid-term examinations:

0

Assessment:

0-5. 70% written examination 30% project work.

Course Materials:

Lecture material will be distributed via Moodle.

Prerequisites:

BJ02A4040 Processing of biomaterials

Places for exchange-students? (Yes, number/No):

Yes, 5

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Business and Management

Grading: Study modules 0-5,P/F

Teachers: Helinä Melkas, Suvi Konsti-Laakso, Suvi-Jonna Martikainen, Rakhshanda Khan, Satu Pekkarinen

Year:

B.Sc. (Tech.) 3

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Helinä Melkas

Aims:

The student learns to understand the significance and meaning of social sustainability in development of business, organization as well as product and service processes. This aim is approached by looking into the theme both from theoretical and practice-based viewpoints. The student gains insight into the kinds of tools and methods that enable social sustainability to become part of business, management as well as product and service development. The student recognizes appropriate situations for applying these methods, and gains elements for critical thinking.

Contents:

Core content: social sustainability at different levels (global, societal and organizational), social innovation, frugal innovation, social enterprise, end-user involvement, employee involvement, human impact assessment Supplementary content: practical cases, methods and Living Lab activities

Teaching Methods:

Lectures (intensive teaching) and small group assignments during the lectures 5 h; case exercise to be given during the lectures 60 h; independent and/or group studies 66 h; presentation of case exercises in a closing seminar 10 h; personal learning diary 15 h = total 156 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Case exercise 70%, learning diary 30%.

Course Materials:

The study materials consist of course slides and selected articles (will be announced later).

Places for exchange-students? (Yes, number/No):

Yes, 15

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

CT10A7002: Green IT and Sustainable Computing, 6 cp**Validity:** 01.08.2016 -**Form of study:** Basic studies**Type:** Course**Unit:** LUT School of Business and Management**Grading:** Study modules 0-5,P/F**Teachers:** Jari Porras**Year:**

M.Sc. (Tech.) 1-2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Jari Porras

Aims:

After the course students are familiar with technologies for Green IT and sustainable computing. Students know critical thinking and argumentation principles and are able to apply these skills in discussions carried over the topic. Students are able to discuss about the topic and examine it critically.

Contents:

The course emphasizes Green IT and sustainable computing field in sustainable development. The topic is covered through books and scientific articles. Students may be divided into small groups that will each study the topic.

Teaching Methods:

Lectures 2 h, seminars and discussions 8 h, homeworks 16 h, self-study 24 h, 3. period.
Seminars and discussions 20 h, homeworks 26 h, self-study 60 h, 4. period. Total 156 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Seminar work(s), active participation in discussions, homeworks.

Course Materials:

To be announced in Moodle pages before the course.

Limitation for students? (Yes, number, priorities/Leave empty):

Yes, 36. Priority is given to Software Engineering students.

Places for exchange-students? (Yes, number/No):

Yes, 5

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability

Students, who haven't done BH60A0000 Ympäristötekniikan perusteet in their earlier studies, are required to do Introduction to Sustainability.

BH60A4400: Introduction to Sustainability, 3 cp

Validity: 01.08.2013 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Virgilio Panapanaan, Risto Soukka, Mirja Mikkilä

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Risto Soukka

Aims:

Upon completion of the course the students are expected to be able to:

- 1) explain the interaction between the environment, society and business and understand the relationships of various actors in these fields and their impacts on the society and the environment;
- 2) understand the core idea and thinking behind sustainability and its importance in order to limit or decelerate environmental damages and improve our quality of life while pursuing a more sustainable lifestyle and business within the planetary boundaries;
- 3) understand and apply practically the learned principles and concepts of sustainability in relation to current production and consumption habits;
- 4) know and be guided about the different value-adding activities and tools that promote sustainability; and
- 5) demonstrate the ability to reflect sustainability principles in the assignment, studies and desirably in thinking and lifestyles.

Contents:

The general objective of the course is to introduce students to different sustainability challenges that our world is facing as a consequence of human activities and natural causes. The idea is to learn and understand those sustainability challenges and their interconnectedness, and find out how we could move or transit towards a more sustainable world.

Teaching Methods:

1st period: 14 h of lectures. Independent study (approx. 64 h): assignment (group work) and seminar (approx. 26 h). Preparation for the examination and the exam (approx. 38 h). Total workload 78 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

0 - 5. Examination 70 %, assignment 30 %.

Course Materials:

Will be announced during lectures. Moodle.

Limitation for students? (Yes, number, priorities/Leave empty):

Yes, 80, priority is given to the students who have this course as an obligatory in their degree structure

Places for exchange-students? (Yes, number/No):

No

Places for Open University Students?(Yes, number/No):

This course has 1-5 places for open university students. More information on the web site for open university instructions.

Related to:

to sustainability