Catalogue report

LUT School of Energy Systems

Master's Programme in Mechatronic System Design

Master’s Programme in Mechatronic System Design 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 Mechatronic System Design

After the completion of the Master's Programme in Mechatronic System Design a student will acquire extensive knowledge of the design, hydraulics, control, dynamics and simulation of machines. A student will also learn about environmentally conscious design and the development of new technologies to solve current and future global problems. During the studies, a student will be able to apply simulation tools to analyse demanding machine systems. This expertise can be applied to the most demanding research and development processes of the global industry.

A student will

- be able to demonstrate a comprehensive understanding of dynamics of mechatronic machines, simulation tools and usage of them, multidisciplinary product development process.
- have adopted the principles of applying theoretical methods into practice using virtual tools.
- have ability to design and implement control systems for mechatronic machines.
- be able to work with others in task-orientated groups participating and interacting in the group in a productive manner and lead and manage design projects
- be able to logically think through industrial research and development problems and solve them, to contribute to innovative thinking
- be able to understand the needs and special features of other disciplines out of core competence in mechanical engineering design

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:
Mechatronic System Design

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 Advanced 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 Mechatronic System Design 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)

KoDMecha: Mechatronic System Design, 50 - 70 cp
- *Obligatory Studies 55 ECTS cr*
  - BK10A1501: Master's Thesis and Seminar, 30 cp
  - BK60A0800: Fluid Power, 5 cp

BK60A1001: Control of Mechatronic Machines, 5 cp
BK60A1500: Practical Laboratory Course in Motion Control and Mechatronics, 5 cp
BK70A0501: Machine Dynamics, 5 cp
BK70A0102: Simulation, Laboratory Course, 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: Harri Eskelinen, Kimmo Kerkkänen

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: Ilkka Pöllänen, Timo Björk

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 Lujuusoppi

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: Sari Pärssinen, Harri Eskelinen, Jörg Wunderlich

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 staring 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. Kalpakjan, 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

KoDMecha: Mechatronic System Design, 50 - 70 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 55 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

BK60A0800: Fluid Power, 5 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: Heikki Handroos, Rafael Åman

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Heikki Handroos

Aims:

To understand the structure and behaviour of fluid power transmission components and systems. Skills for dimensioning hydraulic components for various systems. Skills for designing fluid power transmissions for industrial and mobile machines. Ability to analyse hydraulic components and systems through modelling and simulation.

Contents:

Fluid power system structures, hydraulic fluids, hydraulic transmission lines, pumps, motors, cylinders, basic control valves, servo valves, accessories, hydraulic servo systems, modelling and simulation of hydraulic components and circuits.

Teaching Methods:

Lectures 42 h, periods 3-4. Tutorials 42 h, periods 3-4. Laboratory work 16 h. Independent study 30 h. Total loading 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):

Yes

Assessment:

0-5, examination 75 %, tutorials, assignment and laboratory work 25 %.

Course Materials:

Lecture notes in Moodle. Ebook: Rabie, M. Galal: Fluid Power Engineering, McGraw-Hill, 2009.

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

BK60A1001: Control of Mechatronic Machines, 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: Hamid Roozbahani

Note:

Suitable also for doctoral studies.

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

D.Sc. (Tech.) Hamid Roozbahani

Aims:

Mechatronics is a multidisciplinary field of science that includes a combination of mechanical engineering,
electronics, computer engineering, telecommunications engineering, systems engineering and control engineering. As technology advances, the subfields of engineering multiply and adapt. Mechatronics' aim is a
design process that unifies these subfields. Originally, mechatronics just included the combination of mechanics
and electronics, hence the word is a combination of mechanics and electronics; however, as technical systems
have become more and more complex the definition has been broadened to include more technical areas.
The aim of this course is to develop theoretical and practical expertise in the field of Mechatronics. Via this
course, students learn to analyze, design, develop and control Mechatronic systems. Programming and control of
Mechatronic systems are an important part of this course which powers up the students IT skills. The application
of control systems covers a wide area of the science and technology in every field and the course provides a
sound basis for the study of both classical and modern techniques.
After having passed this course module, the student will be able to:

- Develop mathematical Model of Mechatronic systems
- Develop control algorithm to control the modeled systems

- Develop simulations based on real mechatronic systems and control both systems
- Design servo control systems for hydraulic, pneumatic and electrical systems e.g. by utilizing the frequency and time domain methods
- Programming and control of mechatronic machines e.g. a robotic systems.

Contents:

This course introduces common industrial servo control systems: hydraulic, pneumatic, and electrical systems.
The dynamic analysis of these servo systems is studied in the time and frequency domain. Different control
strategies are introduced, mainly classical with some concepts of modern control. The design and analysis of
digital control will be introduced. During this course, design, analysis and simulation are conducted using Matlab/Simulink.
The course theoretical content is as below:

- Introduction to the course
- Theory of Control
- Electrical Systems
- Hydraulic Systems
- Pneumatic Systems
- Sensors
- Digital Control
- Signal Processing
- Haptics

Teaching Methods:

Lectures 36 h, 1st-2nd period. Tutorials 36 h, 1st-2nd period. Exercises 14 h, 1st-2nd period. Project work 30 h.
2nd period. Independent study 14 h. 1st-2nd period. Total loading 130 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):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

0-5, final exam 40 %, tutorials: 30 %, final project: 30 %.

Course Materials:

- Lecture notes.
- Selected chapters from the following text books:

[1] Modern Control Engineering (5th Edition): Katsuhiko Ogata
[2] Jelali Mohieddine: “Hydraulic servo-systems, modeling, identification and control”.

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

Yes

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

Further information:

Suitable also for doctoral studies.

BK60A1500: Practical Laboratory Course in Motion Control and Mechatronics, 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: Hamid Roozbahani, Tuomo Lindh

Note:

Suitable also for postgraduate studies.

Year:

M.Sc. (Tech.) 1-2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

D.Sc. (Tech.) Hamid Roozbahani, D.Sc. (Tech.) Tuomo Lindh

Aims:

Mechatronics is a design process that includes a combination of mechanical engineering, electrical engineering, control engineering and computer engineering. Control is the engineering discipline that applies control theory to design systems with desired behaviors. To give the student a deeper understanding of mechatronic systems from the practical perspective. The student will learn how to use experimental tools to verify simulation models and analyzes. He/she is able to form the design of experiments, arrange an appropriate environment for the studied device or machine to get reliable measured results. The student is also able to run the planned tests and analyze the results. In this course, advanced modeling, programming and simulation tools and methods are introduced for students.
Students will learn how the related simulation tools such as MATLAB & SIMULINK can be used to solve and analyze Control and Mechatronic problems. Students learn also how to use modern automation systems in order to implement controllers using SIMULINK, LabVIEW, C programming and IEC 61131-3 programming languages.
This course provides a mathematical basis for problem formulation, and coding/solving using the above-mentioned computational packages. Students will learn how to solve simple control problems using their own codes, algorithms and designs. After this course, they will be able to start working on various topics in mechatronic for advanced designs or analysis.

Contents:

This course introduces common industrial servo control systems: hydraulic, pneumatic, and electro-mechanic systems. The dynamic analysis of these systems is studied in both time- and Frequency - domain. Different control strategies are introduced, mainly classical with some concepts of modern control. Design and analysis of digital control will be introduced.
This course has three major parts: demonstration lectures, tutorials and project work. The course content is as below:

- Introduction to Control & Mechatronics and related problems
- Theoretical and practical expertise in the analysis and design of control systems
- Mechatronic machines e.g., a robotic machine
- The application of control system strategies in wide area of both classical and modern

techniques
- Model and simulation of control of mechatronic machines
- Design control systems for hydraulic, pneumatic and electro-machines e.g., by utilizing the frequency- and time-domain or discrete digital controllers
- LabVIEW training
- NI myRIO training: Using LabVIEW in action for measurement and control using FPGA
- Development of simple mechatronic system to study sensing and actuating
- PLC and embedded control.
- IEC 61131-3 programming
- C programming
- MATLAB & SIMULINK training
- dSPACE Medkit training : Using SIMULINK in action for measurement and control
- Development of simple mechatronic system to study sensing and actuating

Tutorials: (12 Tutorials for 36 hours):
Every week, after every lecture, the student will receive one Tutorial/Exercise to do independently during the week. On the next tutorial session, student and lecturer will check the student's solutions together and then lecturer solves the tutorial for all students. Every tutorial problems is based on the same week lecture topic. Student will receive 25% of his final grade based on his activities for tutorials.

Project work:
A project is done in one of the laboratories of the department. The project is planned together with the supervisor(s) and consists mainly of laboratory work, literature work and report writing. The essential part of the work is to use simulation tools to predict the behavior of the system and verify the results using measurements in practice. The project may also be planned together with industry and then carried out at some industrial location.
Students will teamed up in the first week of the course and the available projects will introduce to them. Every team has the whole semester to:
1. Finalize the project
2. Prepare a report
3. Give a presentation about the project and results

Teaching Methods:

Lectures 36 h, 1st-2nd period. Tutorials 36 h, 1st-2nd period. Independent study and exercise 18 h. Project work 40 h. Total loading 130 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):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

0-5, final exam 25 %, tutorials 25 %, final project 50 %.

Course Materials:

Lecture notes.
Selected chapters from the following text books:
1) Modern Control Engineering (5th Edition): Katsuhiko Ogata
2) Matlab & SIMULINK user manual based on Mathworks database

3) NI LabVIEW
4) Digital Control of Dynamic Systems: Gene F. Franklin
5) Digital Control Systems, Design, Identification and Implementation, Ioan D. Landau

Prerequisites:

The course is designed for students, who have background in mechanical or electrical engineering studies.

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

Yes

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

BK70A0501: Machine Dynamics, 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: Jussi Sopanen

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Jussi Sopanen

Aims:

The student will learn theories and practices of structural dynamics and knows how to apply the knowledge in the design of machine systems. He/she is able to model dynamic machine systems, solve the equations of motion in frequency and time domains and analyze the results from simulations and measurements. The student knows the basics of vibrations measurements and experimental modal analysis. The student is able to review and interpret his/her student mate’s simulation results resembling the tasks in the later career. Some of the practical examples and assignments are real-life cases arising from co-operation with industrial companies.

Contents:

Multiple degree-of-freedom vibrations, solution and interpretation of natural frequencies and modes. Response to the harmonic and general force excitation. Derivation of the equations of motion of the system and solution in the frequency and time domain. Vibration measurements and experimental modal analysis. Introduction to rotor dynamics. Torsional vibrations.

Teaching Methods:

Lectures 28 h, periods 1-2. Supervised tutorials 24 h, periods 1-2. Laboratory work or analysis of measurement results 4 h, homework 40 h, periods 1-2. Preparation for exam 10 h, periods 1-2. Teamwork in a multi-cultural working environment 28 h, periods 1-2. Total workload 134 h. Lectures, tutorials and lab sessions are possible to follow online.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

Yes

Examination in Exam (Yes/No):

No

Assessment:

0-5, online examination or online mid-term examinations 60 %, homework and laboratory exercises 40 %.

Course Materials:

Lecture notes. Inman, D. J.: Engineering vibration, 3rd ed., Pearson Education Inc., New Jersey, 2007. ISBN 0-13-228173-2.

Prerequisites:

Students are recommended to have basic skills on Dynamics. Experience or basic studies of Finite Element Method (FEM) is also recommend, but not required.

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

Yes, 30

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

BK70A0102: Simulation, Laboratory Course, 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:

3-4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

The student will learn the advanced theories and practices of the mathematical modelling and computer simulation of machine systems. The student will be able to utilise advanced simulations to solve a practical design assignment. The student will be able to verify and evaluate the accuracy of simulation models. The student will be able to conduct individual scientific work to analyse the dynamics of machine systems.

Contents:

Spatial kinematics, modelling of flexible bodies in multibody applications, modal reduction methods, real-time simulation, embedded systems, contact modelling, multibody dynamics on failure analysis, vehicle modelling, model verifications, practical measurements.

Teaching Methods:

Lectures 24 h, periods 3-4. Teamwork in a multi-cultural working environment 30 h, periods 3-4. Supervised tutorials 36 h, periods 3-4. Independent study 40 h, periods 3-4. Total workload 130 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Number of mid-term examinations:

2

Assessment:

0-5, examination or mid-course examinations 45 %, simulation work 45 %, in class quizzes 10 %.

Course Materials:

Lecture notes. Shabana, A. A.: Dynamics of Multibody Systems, Cambridge University Press, 3rd edition, 2005. ISBN 0-521-85011-8. Shabana, A. A.: Computational Dynamics, John Wiley & Sons, Inc., 1st edition,1994. ISBN 0-471-30551-0.

Prerequisites:

Recommended: BK70A0000 Simulation of a Mechatronic Machine completed.

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

1

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

Yes, 10

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

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: Antti Salminen, Joonas Pekkarinen

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.

KoDSaMate: Advanced Materials Engineering, 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

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: Timo Kärki, Katriina Mielonen, Marko Hyvärinen

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, undirectional, 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: Mika Lohtander, Esko Niemi

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Reseacrher, 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 socond 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: Sanni Väisänen, Ivan Deviatkin, Risto Soukka

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.

CS30A1691: Social Sustainability, 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: Rakhshanda Khan, Suvi-Jonna Martikainen, Suvi Konsti-Laakso, Helinä Melkas, 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: Risto Soukka, Mirja Mikkilä, Virgilio Panapanaan

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