Opasraportti

LUT School of Energy Systems (23B2)

Diplomi-insinööri Konetekniikka JEDI

Konetekniikan JEDI-diplomi-insinöörin tutkinto-ohjelma 2018-2019

Konetekniikan diplomi-insinöörin tutkinto (120 op)

MSc in Mechanical Engineering (JEDI) is taught in Finnish

Perustietoja

- tutkinto diplomi-insinööri (DI), Master of Science in Technology (M.Sc. Tech.)
- ylempi korkeakoulututkinto, antaa hakukelpoisuuden tieteellisiin jatko-opintoihin
- laajuus 120 op
- opinnot on mitoitettu kahdeksi lukuvuodeksi.

Konetekniikan JEDI-DI-tutkinnon osaamistavoitteet

JEDI-DI-tutkinnon suorittanut opiskelija osaa:

- muodostaa käsityksen mekatronisten koneiden ja laitteiden toiminnasta, niiden dynamiikan analysoinnista ja simuloinnista osana moniteknisten tuotteiden suunnitteluprosessia
- tunnistaa ja soveltaa työssään muiden tekniikan alojen tarpeita ja erityispiirteitä osana tuotekehitysprosessia
- muodostaa käsityksen hitsattavien tuotteiden ja metallirakenteiden suunnittelusta, valmistusmenetelmistä sekä niiden kestoikään ja luotettavuuteen vaikuttavista tekijöistä
- teollisuudessa käytetyimpien ja yleisimpien metallisten materiaalien hitsausprosessien periaatteet
- teollisuudessa käytetyimpien ja yleisimpien valmistusprosessien periaatteet
- hahmottaa loogisesti ja ratkaista innovatiivisesti teollisuudesta esiin nousevia tuotanto- ja valmistusteknisiä ongelmia
- yhdistää materiaalinvalinnan osaksi valmistusystävällisen tuotteen suunnittelua

Tutkintorakenne

Diplomi-insinöörin tutkinto 120 op muodostuu

- ydinopinnoista
- syventymisopinnoista, joihin sisältyy diplomityö
- yhdestä JEDI-DI-ohjelman sivuopintokokonaisuudesta
- mahdollisista valinnaisista opinnoista.

Lisätietoja Uni-portaalissa:
Konetekniikan DI-tutkinto

Tutkintorakenteet

Konetekniikan JEDI-DI-ohjelman tutkinnon rakenne

Konetekniikan JEDI-diplomi-insinöörin tutkinnon laajuus on 120 op. Se koostuu ydinopinnoista, syventymisopinnoista, sivuopinnoista ja mahdollisista valinnaisista opinnoista.

Ydinopintojen laajuus on 20 op.
Syventymisopintojen laajuus on 80 op. Diplomityö ja seminaari (30 op) sisältyvät syventymisopintoihin.
Sivuopintojen laajuus on vähintään 20 op.
Sivuopinnoiksi valitaan yksi seuraavista sivuopintokokonaisuuksista:

- KoDSaPate Modern Packaging Technology and Renewable Materials
- KoDSaLate Laser Processing tai
- KoDSaProte Production Technology

Tutkintoon ei kuulu **valinnaisia opintoja**, mutta opiskelija voi halutessaan suorittaa yliopistotasoisia opintoja 120 op:en ylittäviin opintoihin. Valinnaisiin opintoihin voi valita LUT:n opintojaksoja, myös toisen sivuopintokokonaisuuden. Muiden kotimaisten/ulkomaisten yliopistojen opintoja, Puolustusvoimien johtajakoulutusta tai työharjoittelua (BK10A1400 DI-tutkinnon työharjoittelu 2-10 op) voi sisällyttää valinnaisiin opintoihin (anomuksesta).

Tarkat tiedot löytyvät tutkintorakenteesta.

Konetekniikan diplomi-insinöörin tutkinto JEDI 2018-2019

Tutkintorakenteen tila: hyväksytty

Lukuvuosi: 2018-19

Lukuvuoden alkamispäivämäärä: 01.08.2018

Ydinopinnot (vähintään 20 op)

Kaikille pakolliset ydinopinnot

KoJEDIYdin: Ydinopinnot, 0 - 70 op
Pakolliset opinnot 20 op. Laboratory Work Course in Mechanical Engineering suoritetaan vähintään 14 op:en laajuisena.
BK10A5600: Johdatus etäopiskeluun, 2 op
BK10A1200: Research Methods and Methodologies, 4 op
BK10A1101: Laboratory Work Course in Mechanical Engineering, 2 - 30 op

Syventymisopinnot (vähintään 81 op)

Kaikille pakolliset syventymisopinnot.

KoJEDIKone: Konetekniikka, 93 op
Pakolliset opinnot 80 op
BK10A1501: Master's Thesis and Seminar, 30 op
BK10A4401: Teräsrakenteiden suunnittelu, 5 op
BK10A4501: Renewable Packaging Materials, 5 op
BK20A0403: Modern Welding Processes, 5 op

BK20A2400: Materials and Welding Metallurgy, 5 op
BK20A2600: Modelling and Simulation in Welding, 5 op
BK50A4500: Advanced Metal Materials Processing, 5 op
BK60A0800: Fluid Power, 5 op
BK60A1001: Control of Mechatronic Machines, 5 op
BK70A0001: Simulation of a Mechatronic Machine, 5 op
BK70A0501: Machine Dynamics, 5 op

Sivuopinnot (vähintään 20 op)

Opiskelija valitsee yhden sivuopintokokonaisuuden; joko Modern Packaging Technology and Renewable Materials (KoDSaPate), Laser Processing (KoDSaLate) tai Production Technology (KoDSaProte).

Valinnaiset opinnot

Lisää mahdolliset valinnaiset opinnot.

Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

Sivuopinnot

Sivuopintojen laajuus on vähintään 20 op. Sivuopinnoiksi valitaan yksi seuraavista sivuopintokokonaisuuksista:

KoDSaPate Modern Packaging Technology and Renewable Materials
KoDSaLate Laser Processing tai
KoDSaProte Production Technology

KoDSaLate: Laser Processing, 20 op
Alternative Studies. Choose at least 20 ECTS cr from following courses.
BK30A0803: Digital Advanced Manufacturing with Lasers, 5 op
BK30A0901: Additive Manufacturing - 3D Printing, 5 op
BK30A1201: Laser Materials Processing, 5 op
BK30A1301: Laser Based Manufacturing for Design, 5 op
BK30A1400: Individual Project Work of Laser Technology, 5 op
KoDSaPate: Modern Packaging Technology and Renewable Materials, 20 op
Obligatory Studies 20 ECTS cr
BK10A2801: Coating and Lamination of Fibre Based Packaging Materials, 5 op
BK10A4901: Package Design and Consumer - Package Interaction, 5 op
BK10A5001: Modern Packaging Lines, Machinery and Package Manufacturing, 5 op
BK10A5101: Functional Intelligent Packages, 5 op
KoDSaProte: Production Technology, 20 - 30 op
Obligatory Studies 20 ECTS cr
BK10A3401: Green Fibre Materials, 5 op
BK30A0803: Digital Advanced Manufacturing with Lasers, 5 op
BK50A2701: Selection Criteria of Structural Materials, 5 op
BK50A3700: Productivity and Sustainability in Sheet Metal Production, 5 op

Opintojaksojen kuvaukset

Tutkintorakenteisiin kuuluvien opintokohteiden kuvaukset

KoJEDIYdin: Ydinopinnot, 0 - 70 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Yleisopinnot
Laji: Kokonaisuus
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P

Pakolliset opinnot 20 op. Laboratory Work Course in Mechanical Engineering suoritetaan vähintään 14 op:en laajuisena.

BK10A5600: Johdatus etäopiskeluun, 2 op

Voimassaolo: 01.01.2018 -
Opiskelumuoto: Yleisopinnot
Laji: Opintojakso
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P

Huom:

Opintojakso vain etäohjelmien (JEDI/MEC) opiskelijoille. Toteutetaan uusien etäopiskelijoiden tutustumispäivän yhteydessä.

Suoritusvuosi:

DI 1

Periodi:

1

Opetuskieli:

Suomi

Vastuuopettaja(t):

Harri Eskelinen, professori, TkT,
Katriina Mielonen, yliopisto-opettaja, TkT

Tavoitteet:

Opiskelija tutustuu konetekniikan koulutusohjelmaan ja yliopisto-opiskeluun sekä etäohjelman etäopetusympäristöön. Opiskelija osaa suunnitella opintojansa ja seurata edistymistä omien tavoitteidensa mukaisesti. Opiskelija tutustuu yliopiston tiedekirjaston palveluihin sekä oppii konetekniikan tiedonhaun alkeet.Opiskelijatutustuu yliopiston tietoturva-asioihin.

Sisältö:

Opintojakson suoritettuaan opiskelija osaa kuvailla diplomi-insinöörin tutkinnon yleisrakenteen ja siihen sisältyvät osiot. Opiskelija hahmottaa opintojensa opintopolun sekä henkilökohtaisen opintosuunnitelman merkityksen opintopolun eri vaiheissa. Opiskelija osaa etsiä omiin opintoihinsa liittyvää neuvontamateriaalia sekä neuvontahenkilöstöä. Opiskelija tunnistaa kirjaston tarjoamat palvelut ja osaa konetekniikan tiedonhaun alkeet. Opiskelija tuntee etäohjelman etäopetusympäristön eri palvelut ja käytettävät työkalut.

Suoritustavat:

Luennot 6 h, 1. periodi. Tutustumispäivän ohjelman voi jälkikäteen seurata myös Moodlen kautta. Omaehtoista työskentelyä 46 h. Kokonaismitoitus 52 h.
Opintojakso soveltuu myös etäopiskeluun.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

Ei

Moodle-tentti (Kyllä/Ei):

Ei

Exam-tentti (Kyllä/Ei):

Ei

Arviointi:

Hyväksytty/hylätty. Hyväksytysti suoritetut oppimistehtävät Tiedonhaun perusteet-verkkokurssilla. Henkilökohtaisen opintosuunnitelman (HOPS) laatiminen. Tietoturvatehtävän suorittaminen.

Oppimateriaalit:

Opetusmateriaali Moodlessa.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

Ei

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

Ei

BK10A1200: Research Methods and Methodologies, 4 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Opettajat: Harri Eskelinen

Huom:

The course is arranged concurrently in face-to-face learning and distance learning environment. Replaces the course BK10A1700 Tutkimusmetodiikka JEDI.

Suoritusvuosi:

M.Sc. (Tech.) 2

Periodi:

1-2

Opetuskieli:

English

Vastuuopettaja(t):

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

Tavoitteet:

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.

Sisältö:

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.

Suoritustavat:

For face-to face learning (1-2 period): Introduction lecture 2 h, 1st period, Learning diary 26h 1st period, Personal guidance and literature search 28 h, 2nd period. Written research plan 48 h, 2nd period. Total workload 104 h.
For distance learning (non-stop): Independent study and literature search 54 h, Written research plan 48 h, Skype-exam and -meetings 2h, Total workload 104 h.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

No

Exam-tentti (Kyllä/Ei):

No

Arviointi:

For face-to face learning, 0-5, Learning diary 50 %, Written research plan 50 %
For distance learning: 0-5, Written research plan 5 0%, Skype-exam 50 %

Oppimateriaalit:

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

Osallistujamäärää rajoitettu? (Kyllä, lukumäärä, prioriteetit/Jätä tyhjäksi):

The possibility to pass the course via distance learning is meant only for students of LUT's distance learning programs (JEDI, MEC).

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

No

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

No

BK10A1101: Laboratory Work Course in Mechanical Engineering, 2 - 30 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Opettajat: Harri Eskelinen

Huom:

The course is mainly intended for foreign visiting or exchange students and students of distance learning programs. The students register for the course by contacting at first the person in charge either in the beginning of the 1st or 3rd period. The course is arranged concurrently in face-to-face learning and

distance learning environment.
Replaces the course BK10A1801 Individual Project Work JEDI.

Suoritusvuosi:

M.Sc. (Tech.) 1

Periodi:

Depinding of the project type, 1-4

Opetuskieli:

English

Vastuuopettaja(t):

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

Tavoitteet:

The aim of this course is to
- give the student a deeper understanding on mechanical engineering in a specialized area, e.g. welding technology, design of welded metal structures, laser processing, mechatronics, machine dynamics or sustainable production including applications of packaging technology
- is to give vision about entrepreneurship and
- prepare the studentfor a scientific approach in the M.Sc. thesis work.

Sisältö:

A specific project which is done either in one of the laboratories of the department of Mechanical Engineering or in a suitable industrial company. The project is planned together with the supervisor and it could consist of laboratory work, literature research together with reporting, article writing or problem solving in industry. The course module highlights the aspects of entrepreneurship.

Suoritustavat:

Either face-to-face or Skype meetings. Individual project work and written report. The amount of work hours in the project will determine the amount of credits, 1 ECTS credit corresponds 26 h work .Credits will be granted when the final report is delivered. Extra credits can be received if specific examinations are made.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

No

Exam-tentti (Kyllä/Ei):

No

Arviointi:

0-5 or pass/fail, depending on the project type carried out.

Oppimateriaalit:

Basic guidelines and materials are available in Moodle.

Esitietovaatimukset:

B.Sc.(Mech.Eng.) Degree or equivalent knowledge.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

max 15

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

max 5

KoJEDIKone: Konetekniikka, 93 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Pääaineopinnot
Laji: Kokonaisuus
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P

Pakolliset opinnot 80 op

BK10A1501: Master's Thesis and Seminar, 30 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Yleisopinnot
Laji: Opintojakso
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P
Opettajat: Katriina Mielonen

Suoritusvuosi:

M.Sc. (Tech.) 2

Periodi:

1-4

Opetuskieli:

English

Vastuuopettaja(t):

Katriina Mielonen, University Lecturer, D.Sc.
Harri Eskelinen, Professor, D.Sc.

Tavoitteet:

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.

Sisältö:

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.

Suoritustavat:

The Master’s thesis is a written report on the research work involved, presenting the stages of the work, the methods, results and explanations.
1st-4th period. Elevator speech when thesis is ready.
Independent study 776 h. Total workload 780 h. Seminar listening points are valid till the student will graduate.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

No

Exam-tentti (Kyllä/Ei):

No

Arviointi:

0-5, Master’s thesis 100 %. Elevator speech passed.

Oppimateriaalit:

LUT final thesis instructions. Seminar instructions in Moodle.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

No

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

No

BK10A4401: Teräsrakenteiden suunnittelu, 5 op

Voimassaolo: 01.01.2018 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Huom:

Teräsrakenteiden suunnittelun yleisopintojakso, suunnattu maisteriohjelmien opiskelijoille. Korvaa opintojakson BK10A4400 Teräsrakenteiden suunnittelu JEDI.

Suoritusvuosi:

DI 1

Periodi:

3-4

Opetuskieli:

Suomi

Vastuuopettaja(t):

Timo Björk, TkT, Professori
Olli-Pekka Hämäläinen, DI, Nuorempi tutkija

Tavoitteet:

Suoritettuaan kurssin opiskelijat osaavat suunnitella teräsrakenteita vaativiin kohteisiin, myös valmistustekniset näkökohdat huomioon ottaen, mikä tarkoittaa, että he osaavat:

- tunnistaa rakenteen oleelliset mitoituskriteerit
- määrittää rakenteen mitoituskuormat ja tunnistaa liitostyypit kuormituksen perusteella
- määrittää merkitykselliset muodonmuutokset ja jännitykset ja eliminoida niitä tarpeen mukaan
- mitoittaa hitsin a-mitan
- eritellä hitsausliitoksen jännityskeskittymät ja valita sopivan väsymisanalyysin
- mitoittaa levyrakenteita (hitsattuja tai kylmämuovattuja) ottaen huomioon eri stabiiliusilmiöt
- suunnitella rakenteita ja liitoksia plastisen rajatilan mukaan
- arvioida haurasmurtumisen riskiä, erityisesti arktisissa rakenteissa
- suunnitella rakenteita ottaen huomioon myös väännön, estetyn väännön, vinoutumisen, leikkausviiveen, etc.
- optimoida rakenteita, erityisesti lujia ja ultralujia rakenneteräksiä hyödyntäen
- suunnitella pulttiliitoksia

Sisältö:

Vauriokriteereihin, liitostyyppien määritykseen ja muuttuva-amplitudisen kuormituksen käsittelyyn suunnittelutiedoksi. Muodonmuutosten synty, suuruuksien arviointimenetelmät ja pienentämiskeinot. Hitsin staattisen kestävyyden lujuusopillinen tausta. Jännityskeskittymien jaottelu lokalisuuden perusteella ja väsymismitoitusmenetelmät (Nimellinen, Hot spot, ENS, Local Strain ja LEFM). Levy-, sauva- ja palkkirakenteen stabiiliusmitoituksen teoreettinen tausta ja mitoitus (EC3). Palkkien, kehien ja laattojen (=, myötöviiva-) plastisuusteoria. Haurasmurtumiskestävyyden arviointimenetelmät ja hitsausliitoksen materiaaliominaisuuksien huomioon ottaminen laskentamalleissa. Ohutlevyrakenteiden teoria. Rakenteen ja liitosdetaljin tarkoituksenmukainen muotoilu ja optimointi ottaen huomioon rakenteen käytön asettamat vaatimukset, valmistettavuus ja lujien rakennemateriaalien mahdollisuudet. Ruuviliitosten vaurioitumiskriteerit ja mitoitusmenetelmät.

Suoritustavat:

Itseopiskeluna kotilaskutehtävät 70 h. Itsenäistä opiskelua 80 h. Laboratorioharjoitus 10 h. Kokonaismitoitus 160 h.
Opintojakso soveltuu myös etäopiskeluun.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

Ei

Moodle-tentti (Kyllä/Ei):

Kyllä

Exam-tentti (Kyllä/Ei):

Ei

Arviointi:

Tentti 60 % ja kotilaskutehtävät 40 %.

Oppimateriaalit:

Luentomoniste ja sitä tukeva kirjallisuus (ilmoitetaan luentomonisteessa)

Esitietovaatimukset:

Perusmatematiikkaa (yhtälönratkaisu, derivointi, integrointi). Statiikan ja lujuusopin opinnot suoritettuna.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

Ei

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

Ei

BK10A4501: Renewable Packaging Materials, 5 op

Voimassaolo: 01.01.2018 -
Opiskelumuoto: Yleisopinnot
Laji: Opintojakso
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P

Huom:

Replaces the course BK10A4500 Renewable Packaging Materials JEDI.

Suoritusvuosi:

M.Sc. (Tech.) 1

Periodi:

1-2

Opetuskieli:

English

Vastuuopettaja(t):

Professor, D.Sc. (Tech.) Kaj Backfolk
D.Sc. (Tech.) Sami-Seppo Ovaska

Tavoitteet:

After having passed this course the student is able to:
- Understand basics and progresses in packaging materials made from renewable resources
- Explain important and relevant terminology and definitions related renewable materials and packaging materials made thereof
- Compare and define important material properties of various packaging materials
- Choose appropriate packaging material for typical packaging application
- Get familiar with role of packaging materials on sustainability, recycling and environment

Sisältö:

Trends and markets in packaging industry. The manufacture, physical and chemical properties of the major renewable packaging materials: paper, paperboard, corrugated board, polymers including biopolymers. Discuss and analyse future of packaging material made from renewable and non-renewable resources. Energy and source efficient manufacturing of packaging materials (GreenTech, CleanTech). Environmental issues and sustainability, legislation, regulations. Recycling and composting process of packages.

Suoritustavat:

Exercises in Moodle. Exam in Moodle. Independent study 112 h.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

Yes

Exam-tentti (Kyllä/Ei):

No

Arviointi:

1-5, Project work 30 %, exam 70 %.
Evaluation is based on exercises and exam in Moodle.

Oppimateriaalit:

Material in Moodle
Book: Papermaking Science and Technology, ed. H. Paulapuro, Book 18, Paper and Board Grades, Chapters 2 and 5.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

max 5

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

No

BK20A0403: Modern Welding Processes, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Opettajat: Paul Kah

Suoritusvuosi:

M.Sc. (Tech.) 1

Periodi:

1-2

Opetuskieli:

English

Vastuuopettaja(t):

Docent, D.Sc. (Tech.) Paul Kah

Tavoitteet:

The aim of the course is to educate students on various aspects of modern welding processes used in industry. Course laboratory works and exercises feature real examples of welding designer tasks. After having passed this course, the student:

- has a thorough knowledge of most important welding processes that are used in industry, knows their peculiarities and typical applications.
- knows operational principles of processes and understand how to selecting most suitable process to specified applications, taking into account usability, productivity, and economy aspects.
- understands the relationship between welding process, quality, cost-effective production, energy saving, and sustainability, when selecting proper welding process for different applications.
- has a general overview of utilizing standards like SFS-EN-ISO in welding production, and quality management, as far as they concern welding processes

Sisältö:

The course consists of lectures, exercises and an obligatory visit to an industrial company to make the student familiar with industrial welding processes and practices. Lecture topics are listed below:

- Major parameters, productivity, usability, and efficiency of major welding processes (Manual Metal Arc (MMA) welding; Gas Metal Arc Welding (GMAW); Metal Inert Gas, Metal Active Gas (MIG/MAG) welding; Submerged Arc Welding (SAW), Tungsten Inert Gas (TIG) welding, Plasma welding, Friction Stir Welding (FSW), Laser welding, Electron Beam welding, Hybrid welding, Resistance welding and other)
- The concept of materials weldability
- Mechanization/robotization/automation of welding processes
- Basics of welded structures design
- Welding grooves preparations: cutting and bevelling methods
- Quality, sustainability and safety aspects in a welding workshop

Each lecture has an exercise, which consists of multiple choice and open questions, and some practical assignments based on industrial tasks of a welding engineer, for instance:

- Compare welding processes by productivity and usability aspects
- Define weldability of a certain material
- Describe features of a certain automated welding process
- Evaluate proposed welding designs
- List features concerning welding quality and its control

Additionally, the course has obligatory exercise assignment, which is a report of 10-20 pages written by the student for the whole duration of the course, example topics are:

- Principle, operational parameters and novel developments of a certain welding process
- Weldability of a material group
- Benefits and concerns of welding mechanization/robotization/automation
- Welding quality control for a specific welding process

Suoritustavat:

The course is delivered in a form of lectures with interactive questions and discussions with students. The course also includes practical laboratory exercises. Material delivery and teaching methods:

- Lectures: 24 h
- Seminar presentations and acting as an opponent: 60 h
- Laboratory practice: 8 h including weldability analyses for different materials, products and processes
- Preparation for exam: 38 h

Total workload: 130 h
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

Yes

Moodle-tentti (Kyllä/Ei):

No

Exam-tentti (Kyllä/Ei):

Yes

Arviointi:

- Grading: numerical assessment (0-5)
- Exam: 50 %
- Exercises: 50 %

Oppimateriaalit:

- Course lecture slides
- Howard & Gray: Modern Welding Technology 6th edition. AWS Welding Handbook, 9th edition.
- Welding production standards, e.g. EN ISO 2553, 3834, 4063, 5173 + A1, 5178, 5817, 6520, 6947, 9013, 9017, 9606, 9692, 9712, 13916, 13920, 14731, 14732, 15607, 15609, 15610, 15611, 15612, 15613, 15614, 17635, 17662, 17663; EN 1011, 1090 13479; and ISO/TR 15608, 20172
- Videos of industrial welding operations and processes given at lectures

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

max 10

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

max 10

BK20A2400: Materials and Welding Metallurgy, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Opettajat: Paul Kah

Suoritusvuosi:

M.Sc. (Tech.) 1

Periodi:

3-4

Opetuskieli:

English

Vastuuopettaja(t):

Docent, D.Sc. (Tech.) Paul Kah
Post-Doctoral Researcher, D.Sc. (Tech.) Eric Mvola Belinga

Tavoitteet:

This course aims to provide the student with an understanding of the microstructures and metallurgical characteristics of welded joints in ferrous and non-ferrous alloys, the formation of weld defects and how the metal and heat source interaction affects microstructure and strengthening behaviour of different alloys. Course exercise features real example in welding engineering. On successful completion of this course, a student should be able to:

- Define the practical applications of metallurgy

- Identify fundamental principles and practices of welding metallurgy
- Predict and analyse the macro and microstructures of the welded joint
- Explain the causes of defects in welds and how they can be avoided
- Carry out weld joint characterization
- Identify the composition and classification of base metals
- Describe the principles of metal corrosion
- Explain the physical characteristics and mechanical properties of metals
- Identify grain structures and hard-facing of a weldment
- Demonstrate field identification methods for base metals
- Demonstrate preheat, inter-pass and post-weld heat treatment of metals
- Identify hydrogen cracking and the effects of welding on metals
- Identify metallurgical considerations for welding ferrous and non-ferrous metals
- Demonstrate heat treatment and its impact on metals
- Relate hardness to other properties including metals
- Recommend procedures and methods necessary to prevent the formation of undesirable phases and weld, defects for dissimilar metallic alloys
- Use software for welding metallurgy modelling

Sisältö:

The course consists of lectures, which topics are listed below:

- Welding Metallurgy principles
- Weldability of metals and non-metal materials
- Solidification of welds and factors imposing
- Welding energy/heat input and their effect on welding
- Heat treatments
- Cracks and fracture phenomenon
- Fundamentals of corrosion
- Weldability tests
- Metallurgical quality of weld and failure analyses
- Principles of metallographic examinations

Each lecture has an exercise, which consists of multiple choice and open questions, and some practical assignments are industry related tasks of a welding engineer, for assessing:

- Utilisation of software to predict and model phase transformation
- Characterization welded joint
- Sample preparation, micrograph analyses and quantification
- Understanding of the weld solidification principle
- Identification and avoiding the risk of premature failure
- Relating microstructure to the welded joint performance
- Adapting effective approach to WPS base on metallurgical knowledge

Suoritustavat:

The course is delivered in the form of lectures with interactive questions and discussions with students.
Material delivery and teaching methods:

- Lectures and interactive exercises: 70 h
- Laboratory exercises: 14 h including sample preparation, micrograph analyses and quantification
- Preparation of exercises: 22 h
- Preparation for exam: 24 h

Total workload: 130 h

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

Yes

Moodle-tentti (Kyllä/Ei):

No

Exam-tentti (Kyllä/Ei):

Yes

Arviointi:

Grading: numerical assessment (0-5)

Exam: 50 %
Obligatory exercises: 50 %
Practical exercises are obligatory

Oppimateriaalit:

- Course lecture slides
- Welding: Principles and Applications; L. Jeffus, 2016, Cengage Learning
- Welding Metallurgy, Kou, S, 2003, Second Edition, Wiley
- Modern Welding Technology; Howard B. Cary, Scott Helzer, Sixth Edition, Pearson
- Welding Metallurgy and Weldability, John C. Lippold., 2015,
- Applied Welding Engineering; Processes Codes and Standards, Ramesh Singh, 1st Edition, Elsevier

Esitietovaatimukset:

Basic understanding of welding processes and materials sciences.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

max 10

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

max 10

BK20A2600: Modelling and Simulation in Welding, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Opettajat: Esa Hiltunen

Huom:

Replaces the course BK10A4800 Virtual Welding JEDI

Suoritusvuosi:

M.Sc. (Tech.) 2

Periodi:

1-2

Opetuskieli:

English

Vastuuopettaja(t):

M.Sc. (Tech.) Esa Hiltunen

Tavoitteet:

After completing this course the student is able to recognize the characteristics of welding arc and heat flow as well as estimate their effecton weld pool behavior and parent metal. In addition, the student will be ableto interpret the metallurgical effects in the parent metal and contraction andresidual stress in welded structure. The student will be aware of modern ITProducts available in development of workshop operations. The student will beable to use simulation software to model a robot welding station, simulate its operation and make offline programming.

Sisältö:

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

Suoritustavat:

Lectures 14 h, exercises 56 h, home works 60 h. Preparation for examination and examination. Total workload 130 h.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

Yes

Moodle-tentti (Kyllä/Ei):

No

Exam-tentti (Kyllä/Ei):

No

Arviointi:

0-5. Examination 30 %, exercises and home works 70 %.

Oppimateriaalit:

Lectures in Moodle.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

max 10

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

max 5

BK50A4500: Advanced Metal Materials Processing, 5 op

Voimassaolo: 01.01.2018 -
Opiskelumuoto: Yleisopinnot
Laji: Opintojakso
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P

Huom:

Replaces the course BK10A2601 Tuotantotekniikan erityisopintojakso JEDI 6 op.

Suoritusvuosi:

M.Sc. (Tech.) 2

Periodi:

3-4

Opetuskieli:

English

Vastuuopettaja(t):

Professor, D.Sc. (Tech.) Juha Varis

Tavoitteet:

Students are able to explain how the production is part of company’s strategy and they are able to use this knowledge when improving the production to be a part of the strategy. The student is able to design and manage manufacturing systems, the focus is in special methods. Students are able to integrate production processes. The student can conduct companies’ complex research, design, production and development projects. Students are also able to work in an international and multicultural company. The student is able to draw up a comprehensive technical scientific report. Students are able to search and critically evaluate information on the latest trends in the production and production studies, and to apply that knowledge in order to solve research problems in production technology. Students are able to express their own viewpoints related to manufacturing technology and present the results of its own investigation, as well as in writing and orally. The student is able to critically evaluate research findings / research reports and give constructive feedback.

Sisältö:

Principles, application areas, the physical principles, comparison, and selection criteria in conventional machining processes. Complementary manufacturing processes; fine blanking, electrohydraulic forming, magnetic impulse forming, hydroforming of tubular materials, special roll forming, and special metal cutting methods. Finding and comparing suitable production management models based on novel manufacturing technologies. Formation of product's manufacturing costs and determination of the volume of production, calculation and interpretation. Factors to be taken into account when machine tools are purchased, implemented to be a part of the production, running on hold and condition monitored. Meaning of the collaboration of product development and manufacturing and computer-aided technologies (CAD, CAP, PPS, CAM) and the utilization of modulation, standardization and design for manufacturing and assembly (DFMA) in industry-production development tasks. The meaning of Rapid prototyping technologies for small-batch manufacturing design and manufacturing. Seminar works are widely covering manufacturing topics.

Suoritustavat:

Lecture 26 h available at Moodle, 3.-4. period. Seminar lecture 2h, 3rd period. Seminars 10 h, 4th period. Seminar work 80 h, 3.-4. period. Independent study 16h. Total workload 130 h.
The course is suitable for distance learning.

Soveltuvuus jatko-opintoihin (Kyllä/Jätä tyhjäksi):

Yes

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

Yes

Exam-tentti (Kyllä/Ei):

No

Arviointi:

0-5, Moodle-exam 60 %, seminar 40 % (oral seminar presentation at LUT and opponent).

Oppimateriaalit:

Course material in Moodle.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

No

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

No

BK60A0800: Fluid Power, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Opettajat: Heikki Handroos

Huom:

The course is suitable both for the students present in LUT and for students participating distantly. The major part of activities such as lectures and tutorials are given through Moodle. The activities required may slightly vary between the two groups.
Replaces the course BK10A3000 Fluid Power JEDI

Suoritusvuosi:

M.Sc. (Tech.) 1

Periodi:

3-4

Opetuskieli:

English

Vastuuopettaja(t):

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

Tavoitteet:

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.

Sisältö:

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.

Suoritustavat:

Video lectures recorded in Moodle 42 h, periods 3-4. Tutorials and simulation assignment 42 h, periods 3-4. Laboratory work 16 h including modelling and simulation of a fluid power transmission system. Independent study 30 h. Total workload 130 h.
The course is suitable for distance learning.

Soveltuvuus jatko-opintoihin (Kyllä/Jätä tyhjäksi):

Yes

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

Yes

Exam-tentti (Kyllä/Ei):

Yes

Arviointi:

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

Oppimateriaalit:

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

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

max 5

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

max 5

BK60A1001: Control of Mechatronic Machines, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Opettajat: Hamid Roozbahani

Huom:

BK10A4600 Control of Mechatronic Machines JEDI

Suoritusvuosi:

M.Sc. (Tech.) 1

Periodi:

1-2

Opetuskieli:

English

Vastuuopettaja(t):

D.Sc. (Tech.) Hamid Roozbahani

Tavoitteet:

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.

Sisältö:

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

Suoritustavat:

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.
The course is suitable for distance learning.

Soveltuvuus jatko-opintoihin (Kyllä/Jätä tyhjäksi):

Yes

Jatko-opintojakso, jolle ilmottaudutaan WebOodissa (Kyllä/Jätä tyhjäksi):

Yes

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

Yes

Moodle-tentti (Kyllä/Ei):

Yes

Exam-tentti (Kyllä/Ei):

Yes

Arviointi:

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

Oppimateriaalit:

- Lecture notes.
- Selected chapters from the following textbooks:
[1] Modern Control Engineering (5th Edition): Katsuhiko Ogata
[2] Jelali Mohieddine: 'Hydraulic servo systems, modeling, identification and control'.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

15–

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

15–

BK70A0001: Simulation of a Mechatronic Machine, 5 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Yleisopinnot
Laji: Opintojakso
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P
Opettajat: Aki Mikkola

Huom:

Replaces the course BK10A3101 Simulation of a Mechatronic Machine JEDI

Suoritusvuosi:

M.Sc. (Tech.) 1

Periodi:

1-2

Opetuskieli:

English

Vastuuopettaja(t):

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

Tavoitteet:

The student possesses the theories and practices of mathematical modeling and computer simulation of machine systems, which are hydraulically 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.

Sisältö:

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.

Suoritustavat:

Lectures 22 h, 1st-2nd period. Teamwork in multi-cultural working environment 32 h, 1st-2nd period.Supervised tutorials 24 h, 1st-2nd period. Independent study 52 h, 1st-2nd period. Total loading 130 h.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

Yes

Moodle-tentti (Kyllä/Ei):

No

Exam-tentti (Kyllä/Ei):

No

Välikokeiden lukumäärä:

2 (mid-term examinations in Moodle)

Arviointi:

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

Oppimateriaalit:

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

Esitietovaatimukset:

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

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

15–

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

max 15

BK70A0501: Machine Dynamics, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Opettajat: Jussi Sopanen

Huom:

Replaces the course BK10A3201 Machine Dynamics JEDI

Suoritusvuosi:

M.Sc. (Tech.) 2

Periodi:

1-2

Opetuskieli:

English

Vastuuopettaja(t):

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

Tavoitteet:

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.

Sisältö:

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.

Suoritustavat:

Lectures 28 h, periods 1-2. Online tutorials 24 h, periods 1-2. Laboratory work or analysis of measurement results 4 h, homework 68 h, periods 1-2. Preparation for exam 10 h, periods 1-2. Total workload 134 h. Lectures, tutorials and lab sessions are possible to follow online. The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

Yes

Exam-tentti (Kyllä/Ei):

No

Arviointi:

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

Oppimateriaalit:

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

Esitietovaatimukset:

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

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

15–

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

max 10

Tutkintorakenteisiin kuulumattomien opintokokonaisuuksien ja -jaksojen kuvaukset

KoDSaLate: Laser Processing, 20 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Sivuaineopinnot
Laji: Kokonaisuus
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P

Tavoitteet:
After completing this minor subject the student will be able to:
- understand the principles of material processing lasers and laser based manufacturing systems and components
- understand the principles of laser materials processing in various processes for different materials
- utilize the advantages of digital photonic production in product design
- utilize additive manufacturing and 3D printing in product development and production
- apply the information to utilize laser for development of new manufacturing processes
- realizes and is able handle the occupational safety issues of industrial lasers

Alternative Studies. Choose at least 20 ECTS cr from following courses.

BK30A0803: Digital Advanced Manufacturing with Lasers, 5 op

Voimassaolo: 01.08.2017 -
Opiskelumuoto: Yleisopinnot
Laji: Opintojakso
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P
Opettajat: Antti Salminen, Ilkka Poutiainen

Huom:

Replaces the course BK10A2401 Digital Advanced Manufacturing with Lasers JEDI

Suoritusvuosi:

M.Sc. (Tech.) 1

Periodi:

1-2

Opetuskieli:

English

Vastuuopettaja(t):

Professor, D.Sc. (Tech.) Antti Salminen
M.Sc. (Tech.) Marika Hirvimäki

Tavoitteet:

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 the risks, hazards and regulations involved in laser materials processing and procedures how these risks are handled in practice
- understand the practical aspects of laser materials processing of different materials
- have skills that are needed in the work life

Sisältö:

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.

Suoritustavat:

Lectures 28 h, 1st and 2nd period. Guided individual working (5x2h) 10 h.
Design, execution and reporting seminar work 92 h. Total work load 130 h.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

No

Exam-tentti (Kyllä/Ei):

No

Välikokeiden lukumäärä:

2 (online mid-term examinations)

Arviointi:

Written individual report 50 %. Evaluation of learning 50%.

Oppimateriaalit:

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

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

No

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

max 5

BK30A0901: Additive Manufacturing - 3D Printing, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Yleisopinnot
Laji: Opintojakso
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P
Opettajat: Heidi Piili, Antti Salminen

Huom:

Replaces the course BK10A2500 Additive Manufacturing - 3D Printing JEDI

Suoritusvuosi:

M.Sc. (Tech.) 2 (M.Sc. (Tech.) 1-2 is also possible in academic year 2018-2019)

Periodi:

3-4

Opetuskieli:

Englanti

Vastuuopettaja(t):

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

Tavoitteet:

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.

Sisältö:

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.

Suoritustavat:

Lectures 28 h, periods 3-4. Tutorials 14 h, periods 3-4. Individual work 88 h. Total workload 130 h.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

Ei

Moodle-tentti (Kyllä/Ei):

Kyllä

Exam-tentti (Kyllä/Ei):

Ei

Arviointi:

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

Oppimateriaalit:

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

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

max 5

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

max 5

BK30A1201: Laser Materials Processing, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Opettajat: Antti Salminen, Ilkka Poutiainen

Huom:

Replaces the course BK10A2300 Laser Materials Processing JEDI

Suoritusvuosi:

M.Sc. (Tech.) 2 (M.Sc. (Tech.) 1-2 is also possible in academic year 2018-2019)

Periodi:

3-4

Opetuskieli:

English

Vastuuopettaja(t):

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

Tavoitteet:

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

Sisältö:

- 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

Suoritustavat:

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.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

No

Exam-tentti (Kyllä/Ei):

Yes

Arviointi:

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

Oppimateriaalit:

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

Esitietovaatimukset:

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

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

Yes, 1-3

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

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

BK30A1301: Laser Based Manufacturing for Design, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Opettajat: Matti Manninen, Ilkka Poutiainen, Joonas Pekkarinen, Antti Salminen

Huom:

Replaces the course BK10A2201 Laser Based Manufacturing for Design JEDI

Suoritusvuosi:

M.Sc. (Tech.) 1

Periodi:

3-4

Opetuskieli:

English

Vastuuopettaja(t):

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

Tavoitteet:

After having passed the course, the student will:
- understand how laser beams and systems are used in materials processing
- realize how these processes can be utilized to full in product development of a company
- be able to compare and generalize the special features gained with creative use of different laser based processes and the impact and utilization of the special features of these processes on product design
- understand what kind of properties can be gained with use of laser based processes and how does this effect on design flow of a product
- understand how the real total cost analysis and sustainability studies can be carried out and how they compete with conventional manufacturing technologies
- Realizes what kind of quality can be reached and how these technologies can be used for increasing energy efficiency and save material.

Sisältö:

The possibilities and limitations of laser processing on the product design. The utilization of laser based processes into design routines and philosophies, together with mechanical properties in comparison with conventional manufacturing technologies. Practical case examples. Economic aspects of laser materials processing. The features of most common laser based processes i.e. various different versions and applications of e.g. laser marking, cutting, welding and surface treatment processes.

Suoritustavat:

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.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

No

Exam-tentti (Kyllä/Ei):

No

Arviointi:

Grade 0-5, written report 70 %, seminar 30 %. Voluntary learning diary.

Oppimateriaalit:

Course material in Moodle.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

max 5

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

max 5

BK30A1400: Individual Project Work of Laser Technology, 5 op

Voimassaolo: 01.08.2016 -
Opiskelumuoto: Yleisopinnot
Laji: Opintojakso
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P
Opettajat: Joonas Pekkarinen, Antti Salminen

Huom:

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

Suoritusvuosi:

M.Sc. (Tech.) 2

Periodi:

1-2

Opetuskieli:

English

Vastuuopettaja(t):

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

Tavoitteet:

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

Sisältö:

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

Suoritustavat:

Lectures 2 h. Guiding discussion with supervisor 15 h. Design, execution and reporting of project work 113 h. Total workload 130 h.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

Ei

Moodle-tentti (Kyllä/Ei):

Ei

Exam-tentti (Kyllä/Ei):

Ei

Arviointi:

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

Oppimateriaalit:

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

Esitietovaatimukset:

BK30A1301 Laser Based Manufacturing for Design or BK30A1201 Laser Materials Processing passed or equivalent understanding shown in oral exam.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

Ei

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

Ei

KoDSaPate: Modern Packaging Technology and Renewable Materials, 20 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Sivuaineopinnot

Laji: Kokonaisuus

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Tavoitteet:
After completing this minor subject the student will be able to:
- describe the most common coating and lamination methods of paper and paperboard
- explain and categorize operations and functions of modern packaging lines
- understand the meaning of design and undestarn basics in material and package development and especially converting and printing
- understand what functional and intelligent package is

Obligatory Studies 20 ECTS cr

BK10A2801: Coating and Lamination of Fibre Based Packaging Materials, 5 op

Voimassaolo: 01.01.2018 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Huom:

BK10A2800 Coating and Lamination of Fibre Based Packaging Materials JEDI

Suoritusvuosi:

M.Sc. (Tech.) 1

Periodi:

3-4

Opetuskieli:

English

Vastuuopettaja(t):

Professor, D.Sc. (Tech.) Kaj Backfolk, D.Sc. (Tech.) Katriina Mielonen

Tavoitteet:

After having passed this course, the student will be able to:
- Decribe the most common coating and lamination methods of paper and paperboard
- Compare various ways to combine materials with paper and board
- Compare and evaluate their properties in different packaging and choose the appropriate packaging material for typical packaging applications.

Sisältö:

Raw materials for the main coating and laminating methods. Main properties (including printing) of the finished products. Focus on the extrusion coating process. The main applications of polymer coated paper based packaging materials in the packaging sector. Combined packaging structures and their manufacturing techniques.

Suoritustavat:

Exercises and exam in Moodle. Independent study 120 h.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

Yes

Exam-tentti (Kyllä/Ei):

No

Arviointi:

Evaluation is based on exercises and exam in Moodle.

Oppimateriaalit:

Materials in Moodle.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

No

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

No

BK10A4901: Package Design and Consumer - Package Interaction, 5 op

Voimassaolo: 01.01.2018 -
Opiskelumuoto: Yleisopinnot
Laji: Opintojakso
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P

Huom:

Replaces the course BK10A4900 Package Design and Consumer - Package Interaction JEDI.

Suoritusvuosi:

M.Sc. (Tech.) 2

Periodi:

1-2

Opetuskieli:

English

Vastuuopettaja(t):

Post-graduate researcher, D.Sc. Sami Matthews
Post-graduate researcher, D.Sc. Amir Toghyani

Tavoitteet:

After taking this course students is able to understand:
- Basics in material and package development and especially converting and printing
- Influence of the importance of package design
- Consumer behavior trends on package design and requirements
- Compare and analyze different modern printing methods in sustainable packaging materials
- Development trends and value addition through utilizing new techniques

Sisältö:

Basic converting and printing methods, converting and printing on package materials made from renewable resources, package design, pre-press operation, main printing technologies of packages, modern printing technologies and trends, consumer behavior trends, consumer-package interaction, functional printing, requirements of printed packages, future trends and sustainability in packages

Suoritustavat:

Exercises in Moodle and individual project assignment. Self studies 100 h. Individual project work 30 h. Total workload 130 h.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

Yes

Exam-tentti (Kyllä/Ei):

No

Arviointi:

1-5 based on 75 % weekly assignments and 25 % individual project work.

Oppimateriaalit:

Relevant reading assignments and case studies.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

max 5

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

No

BK10A5001: Modern Packaging Lines, Machinery and Package Manufacturing, 5 op

Voimassaolo: 01.01.2018 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Huom:

Replaces the course BK10A5000 Modern Packaging Lines, Machinery and Package Manufacturing JEDI.

Suoritusvuosi:

M.Sc. (Tech.) 1

Periodi:

3-4

Opetuskieli:

English

Vastuuopettaja(t):

Professor. D.Sc Kaj Backfolk, D.Sc. Ville Leminen

Tavoitteet:

After this course student is able to:
- Explain and categorize operations and functions of modern packaging lines
- Construct and develop packaging in solutions

Sisältö:

The unit processes of modern packaging line, the main components of a packaging line, The main filling technologies. Technologies used in carton packaging and flexible packaging, pouch, wrapping, form-fill-seal. Instrumentation, automation, robotics in packaging lines. Integrated smart sensors and solutions. Digitalization in converting.

Suoritustavat:

Lectures in Moodle, week assignments, independent study 80 h.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

Yes

Exam-tentti (Kyllä/Ei):

No

Arviointi:

0-5. Evaluation is based on exam and week assignment reports.

Oppimateriaalit:

Material will be informed in Moodle

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

max 5

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

No

BK10A5101: Functional Intelligent Packages, 5 op

Voimassaolo: 01.01.2018 -
Opiskelumuoto: Yleisopinnot
Laji: Opintojakso
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P

Huom:

Replaces the course BK10A5100 Functional Intelligent Packages JEDI.

Suoritusvuosi:

M.Sc. (Tech.) 2

Periodi:

1-2

Opetuskieli:

English

Vastuuopettaja(t):

Professor, D.Sc. Kaj Backfolk, D.Sc. Krista Koljonen

Tavoitteet:

After taking this course students is able to understand:
- Understand and describe functional and intelligent package
- Requirements for the functional and intelligent packages
- Smart packages and communication, internet and wireless communication
- Design intelligent and smart package
- Role of legislation, regulations and sustainability for functional and intelligent packaging

Sisältö:

Intelligent and smart packaging, functional coating and content-package interaction, digitalization, internet of things, Logistic – impact of smart solutions, consumer behavior trend, hybrid packages, sustainability, recycling, Internet shopping – packaging.

Suoritustavat:

Two individual assignments (50 %/each), instructions in Moodle. Independent study 130 h. Total workload 130 h.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

No

Exam-tentti (Kyllä/Ei):

No

Arviointi:

0-5 based on two individual assignments (50 % each).

Oppimateriaalit:

Material in Moodle

Esitietovaatimukset:

BK10A4501 Renewable Packaging Materials 5 op, BK10A2801 Coating and Lamination of Fibre Based Packaging Materials 5 op, BK10A5001 Modern Packaging Lines, Machinery and Package Manufacturing 5 op

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

max 5

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

No

KoDSaProte: Production Technology, 20 - 30 op

Voimassaolo: 01.08.2018 -
Opiskelumuoto: Sivuaineopinnot
Laji: Kokonaisuus
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P

Tavoitteet:
After completing this minor subject the student will be able to:
- select and plan cost-effective and competitive solutions of sheet metal processes and production for industrial applications based on justified arguments
- develop manufacturing and production technologies for laser processed products
- understand the relationships between the selection of structural materials and manufacturing technologies and apply principles of sustainability in material selection
- utilize modern fiber reinforced materials in advanced production technology

Obligatory Studies 20 ECTS cr

BK10A3401: Green Fibre Materials, 5 op

Voimassaolo: 01.01.2018 -
Opiskelumuoto: Yleisopinnot
Laji: Opintojakso
Vastuuyksikkö: LUT School of Energy Systems (23B2)
Arvostelu: Opintojaksot 0-5,H,P

Huom:

BK10A3400 Green Fibre Materials JEDI

Suoritusvuosi:

DI 1

Periodi:

4

Opetuskieli:

Finnish and English

Vastuuopettaja(t):

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

Tavoitteet:

After having passed this course, the student will be able to:
- estimate different fiber resources available
- define concepts and entities related to fiber usage
- determine and explain what properties fibers have in relation to the growth and functions of fiber cells
- compare structures and properties of fiber materials and their effects on the most important practical applications.

Sisältö:

Fiber resources. Practical principles of managing fiber resources. Fiber procurement. Macroscopial and microscopial structure of fiber materials and functions of fiber cells. Physical and mechanical properties. Empirical methods for defining strength properties. Modeling of relations between physical/mechanical/end use properties. Introduction to fiber based composites. The course is related to sustainability.

Suoritustavat:

Lectures 28 h, period 4. Assignments 42 h, period 4. Individua lwork 60 h. Total workload 130 h. The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

No

Exam-tentti (Kyllä/Ei):

No

Arviointi:

0-5, Assignments 100 %.

Oppimateriaalit:

Course material. Handouts. Wood Handbook, Wood as an Engineering Material. Forest Products Laboratory, 2010.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

No

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

No

BK30A0803: Digital Advanced Manufacturing with Lasers, 5 op

Voimassaolo: 01.08.2017 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Opettajat: Antti Salminen, Ilkka Poutiainen

Huom:

Replaces the course BK10A2401 Digital Advanced Manufacturing with Lasers JEDI

Suoritusvuosi:

M.Sc. (Tech.) 1

Periodi:

1-2

Opetuskieli:

English

Vastuuopettaja(t):

Professor, D.Sc. (Tech.) Antti Salminen
M.Sc. (Tech.) Marika Hirvimäki

Tavoitteet:

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 the risks, hazards and regulations involved in laser materials processing and procedures how these risks are handled in practice
- understand the practical aspects of laser materials processing of different materials
- have skills that are needed in the work life

Sisältö:

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.

Suoritustavat:

Lectures 28 h, 1st and 2nd period. Guided individual working (5x2h) 10 h.
Design, execution and reporting seminar work 92 h. Total work load 130 h.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

No

Exam-tentti (Kyllä/Ei):

No

Välikokeiden lukumäärä:

2 (online mid-term examinations)

Arviointi:

Written individual report 50 %. Evaluation of learning 50%.

Oppimateriaalit:

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

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

No

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

max 5

BK50A2701: Selection Criteria of Structural Materials, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Opettajat: Sari Pärssinen, Harri Eskelinen, Jörg Wunderlich

Huom:

The course is arranged concurrently in face-to-face learning and distance learning environment. Replaces the course BK10A2900 Konstruktiomateriaalit ja niiden valinta JEDI

Suoritusvuosi:

M.Sc. (Tech.) 1

Periodi:

3-4

Opetuskieli:

English

Vastuuopettaja(t):

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

Tavoitteet:

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.

Sisältö:

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.
Project work focuses to selecting structural materials for industrial applications.

Suoritustavat:

For face-to-face learning (3-4 period): Introduction lecture 2 h, 3rd period. Learning diary 36 h, 3rd-4th period. Exercises in small teams 28 h, 3rd-4th period. Project work and poster presentation 44 h, 3rd-4th period. Independent study 20
h. Total workload 130 h.
For distance learning (non-stop):Project work 60 h, Independent study 68 h, Skype-exam and-meetings 2 h.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

No

Moodle-tentti (Kyllä/Ei):

No

Exam-tentti (Kyllä/Ei):

No

Arviointi:

For face-to-face learning, 0-5, comprehensive and continuous evaluation 50%, project work 50%
For distance learning: 0-5, Skype-exam 50%, project work 50%

Oppimateriaalit:

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 and distance learning: Eskelinen &
Karsikas, Vihreän teknologian näkökulmat konstruktiomateriaalien valinnassa, ISBN 978-952-265-457-1.

Osallistujamäärää rajoitettu? (Kyllä, lukumäärä, prioriteetit/Jätä tyhjäksi):

The possibility to pass the course via distance learning is meant only for students of LUT's distance learning programs.

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

No

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

No

BK50A3700: Productivity and Sustainability in Sheet Metal Production, 5 op

Voimassaolo: 01.08.2016 -

Opiskelumuoto: Yleisopinnot

Laji: Opintojakso

Vastuuyksikkö: LUT School of Energy Systems (23B2)

Arvostelu: Opintojaksot 0-5,H,P

Opettajat: Juha Varis

Suoritusvuosi:

M.Sc. (Tech.) 2

Periodi:

1-2

Opetuskieli:

Englanti

Vastuuopettaja(t):

Professor, D.Sc. (Tech.) Juha Varis

Tavoitteet:

After having completed this course, the student should:
- be able to recognize and compare different production methods in sheet metal fabricating industry
- be able to understand how the price of the sheet metal component forms
- be able to apply the knowledge of modern sheet metal manufacturing in practice
- be able to manufacture sheet metal components and assemblies in own factory
- be able to purchase sheet metal components and assemblies from subcontractors
- be able to understand the simulation, automation and robotics importance of the efficient manufacture of sheet metal components and assemblies
- know how to design sheet metal products with 3D software and simulate the manufacturability of

different sheet metal components
- be able to recognize the connection of 3D design to used materials, manufacturing methods and machine systems and their goal of sustainable and productive manufacturing

Sisältö:

The course focuses on manufacturing and manufacturability of sheet metal products in such a way that the students will reach a comprehensive understanding of the manufacturing cost factors in sheet metal products manufacturing. Material quality, different coatings, subassembly's accuracy, process properties and as well as qualitative preparations of multi-technical products are affecting to sheet metal subassembly' and finalassembly'. These aspects are explored in this course. In addition, the focus of this course ison sheet metal production: in automation practices and safety issues. The course covers traditional and automated sheet metal manufacturing processes' trends and visions. Numerous case examples used in this course are straight from the real world, examples are analyzed and solutions are searched in teams. The course is related to sustainable development.
Lecture topics:
- Raw materials; sheet and platemetal materials
- Cutting of materials; principle of cutting and machine tools for cutting
- Punching of materials; principle of punching and punch presses
- Special tools for punching and bending; new trends in tool sector
- DFMA aspects in sheet metal products
- Presses
- Bending of materials; principle of bending and bending devices
- Fine blanking
- Press tooling
- Storing materials; sheet and platematerials, semi-finished products and assembly parts
- Sheet metal production; LEAN aspects, quality and productivity
- Mechanical joining methods
Factory visit:
- Factory visit to sheet metal parts fabricatingcompany
Laboratory exercises:
- 3D-planning of sheet metal parts(x2)
- Punch press environment;programming and use (x2)
- Press brake environment;programming and use (x2)
- Cutting of materials using shearand mechanical joining methods
- Production planning and production capacity calculations

Suoritustavat:

Lectures and factory visit 26h, laboratory exercises and individual guidance 16 h, project work and seminar 38 h,independent work
50 h. Total workload 130 h.
The course is suitable for distance learning.

Kuulustelujärjestyksen mukainen tentti (Kyllä/Ei):

Ei

Moodle-tentti (Kyllä/Ei):

Ei

Exam-tentti (Kyllä/Ei):

Kyllä

Arviointi:

0-5; exam 50 %, exercises 30 %, project work 20 %

Oppimateriaalit:

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

Vaihto-opiskelijoille paikkoja? (Kyllä,paikkamäärä/Ei):

Ei

Paikkoja avoimen yliopiston opiskelijoille? (Kyllä, paikkamäärä/Ei):

Ei