Catalogue report

LUT School of Energy Systems

Master's Programme in Sustainability Science and Solutions

Master’s Programme in Sustainability Science and Solutions 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 MSc programme in Sustainability Science and Solutions

Students who have completed their M.Sc. (Tech.) degree in Sustainability Science and Solutions are able to:

- take responsibility for managing environmental issues
- take responsibility for developing environmental issues
- anticipate the importance of sustainability challenges in the future
- work as a public environmental authority

Students will

- recognise the most significant environmental impacts of products and processes and their importance in terms of business
- understand the requirements of systemic change
- analyse how competitive in terms of environmental impacts and costs a certain technology, product or service is in different operating environments
- assess the technical possibilities of industrial, service, community, and primary production processes and systems to minimise environmental impacts
- explain the complex interdependencies of both local and global environmental problems
- apply theories and the most recent scientific knowledge to solve problems involving environmental aspects
- work as an environmental expert in a range of decision-making situations and produce and convey information to support stakeholders in environmental decision-making
- adopt and innovate new technical solutions to develop the environmental sector

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.

The MSc in Sustainability Science and Solutions s is also available as a Double Degree Programme for the students of our partner universities. The Double Degree Programme has a separate degree structure of its own.

See Uni-portal:
Sustainability Science and Solutions

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). Students are recommended to choose one of the following minors:

YmDSaEnergy Global Energy Revolution
YmDSaSuun Energiajärjestelmien suunnittelu or
YmDSaPuhTek Puhtaan teknologian kilpailukyky

If the required prerequisites in the course BL20A1600 Smart Grids 5 ECTS cr in the minor subject Global Energy Revolution aren't fulfilled, students are recommended to choose either BL10A8400 Solar Economy and Smart Grids 3 ECTS cr (LUT Summer School course) or BL40A2301 Energy Efficiency 6 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 (BH60A3700 Work Internship in Master's Degree, 2-10 ECTS) may be included upon application, too.

The MSc in Sustainability Science and Solutions s is also available as a Double Degree Programme for the students of our partner universities. The Double Degree Programme has a separate degree structure of its own.

See the degree structure for details.

Master's Programme for Double Degree Students/Sustainability Science and Solutions 2017-2018

Degree structure status: published

Academic year: 2017-18

Beginning date of the academic year: 01.08.2017

Core Studies

Language Studies (min 0 cp)

Specialisation Studies (min 60 cp)

YmDSustaDD: Sustainability Science and Solutions, Double Degree, 40 - 70 cp

Obligatory Studies 60 ECTS cr
BH60A5000: Master's Thesis, 30 cp
BH60A4600: Introduction to M.Sc. Studies, 1 cp
BH60A0252: Solid Waste Management Technology, 7 cp
BH60A0451: Air Pollution Control, 6 cp
BH60A0652: Sustainable Water Use, 6 cp
BH60A4700: Climate Finance and Carbon Markets, 3 cp
BH60A2101: Advanced Course in Life Cycle Assessment, 7 cp

Credit Transfer

Free Elective Studies (min 10 cp)

Choose a min. of 10 ECTS cr 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 especially courses from minor studies in Global Energy Revolution, Energiajärjestelmien suunnittelu and Puhtaan teknologian kilpailukyky in free elective studies.

Students are recommended to include also following studies in free elective studies (especially language studies):

- A350A0500 Sustainable Strategy and Business Ethics
- BH50A0400 Vedenkäsittely
- BH60A0150 Projektityöskentely 1
- BH60A4301 Environmental Technology Project Work
- BH60A4400 Introduction to Sustainability
- BH61A0500 Puunjalostusteollisuuden energiatalous
- BK50A2701 Selection Criteria of Structural Materials
- BL40A2600 Tuuli- ja aurinkovoimateknologia ja liiketoiminta
- FV11A6500 Presenting in English
- KIEN0001 Academic Writing in English
- An internship a maximum of 10 ECTS credits. More information: BH60A3700 Work Internship in Master’s Degree.

Sustainability Science and Solutions 2017-2018 (muok. 28.6.2017)

Degree structure status: published

Academic year: 2017-18

Beginning date of the academic year: 01.08.2017

Core Studies (min 23 cp)

YmDCore: Core Studies, 20 - 40 cp
Obligatory Studies 23-27 ECTS cr
BH60A2101: Advanced Course in Life Cycle Assessment, 7 cp
BH60A2701: Energy Efficient Environment, 6 cp
BH60A3001: Corporate Responsibility and Management 2, 5 cp
BH60A3501: Sustainable Innovation and System Transition, 5 cp
Students, who haven´t done Johdatus ympäristötekniikan opiskeluun, are required to do Introduction to M.Sc. Studies
BH60A4600: Introduction to M.Sc. Studies, 1 cp

Students, who haven´t done Yritysvastuu ja johtaminen 1, are required to do Corporate Responsibility and Management 1.

BH60A4500: Corporate Responsibility and Management 1, 3 cp

Specialisation Studies (min 59 cp)

YmDSusta: Sustainability Science and Solutions, 40 - 70 cp

Obligatory Studies 55 ECTS cr

BH60A5000: Master's Thesis, 30 cp
BH60A0252: Solid Waste Management Technology, 7 cp
BH60A0451: Air Pollution Control, 6 cp
BH60A0652: Sustainable Water Use, 6 cp
BH60A1201: Indoor Climate Management of Buildings, 7 cp
BH60A4700: Climate Finance and Carbon Markets, 3 cp

Minor Studies (min 20 cp)

Students may choose any minor studies taught at LUT if the required prerequisites are fulfilled. Students are recommended to choose minor studies Global Energy Revolution (code YmDSaEnergy), Energiajärjestelmien suunnittelu (code YmDSaSuun) or Puhtaan teknologian kilpailukyky (code YmDSaPuhTek).

If the required prerequisites in the course BL20A1600 Smart Grids 5 ECTS cr in the minor subject Global Energy Revolution aren't fulfilled, students are recommended to choose either BL10A8400 Solar Economy and Smart Grids 3 ECTS cr (LUT Summer School course) or BL40A2301 Energy Efficiency 6 ECTS cr.

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 especially courses from minor studies in Global Energy Revolution, Energiajärjestelmien suunnittelu and Puhtaan teknologian kilpailukyky in free elective studies.

Students are recommended to include also following studies in free elective studies (especially language studies):

- A350A0500 Sustainable Strategy and Business Ethics
- BH50A0400 Vedenkäsittely
- BH60A0150 Projektityöskentely 1
- BH60A2801 Energy and Environmental Challanges in Russia
- BH60A4301 Environmental Technology Project Work
- BH60A4400 Introduction to Sustainability
- BH61A0500 Puunjalostusteollisuuden energiatalous
- BK50A2701 Selection Criteria of Structural Materials
- BL40A2600 Tuuli- ja aurinkovoimateknologia ja liiketoiminta
- FV11A6500 Presenting in English
- KIEN0001 Academic Writing in English
- An internship a maximum of 10 ECTS credits. More information: BH60A3700 Work Internship in Master’s Degree 2-10 ECTS cr.

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).

Students are recommented to choose one of the following minors:

YmDSaEnergy Global Energy Revolution
YmDSaSuun Energiajärjestelmien suunnittelu or
YmDSaPuhTek Puhtaan teknologian kilpailukyky

If the required prerequisites in the course BL20A1600 Smart Grids 5 ECTS cr in the minor subject Global Energy Revolution aren't fulfilled, students are recommended to choose either BL10A8400 Solar Economy and Smart Grids 3 ECTS cr (LUT Summer School course) or BL40A2301 Energy Efficiency 6 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

Mechanical Engineering:
KoDSaKote Konetekniikka (in Finnish)
KoDSaManu Modern Manufacturing
KoDSaLaser Advanced Digital Laser Based Photonic Production
KoDSaMate Advanced Materials Engineering

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)

YmDSaPuhTek: , 20 - 30 cp
Obligatory Studies 24 ECTS cr
A250A0160: Introduction to Environmental Economics, 6 cp
CS30A1691: Social Sustainability, 6 cp
CS31A0610: Life-Cycle Costing of Investment Projects, 6 cp
CT10A7002: Green IT and Sustainable Computing, 6 cp
YmDSaSuun: , 20 - 30 cp
Pakolliset opinnot 22 op
BH50A0400: Water Treatment, 2 cp
BH50A1800: Fundamentals of Energy Systems Planning, 6 cp
BH50A1900: Planning of Energy Systems, 4 cp
BH60A2401: Energy Recovery from Solid Waste, 4 cp
BK50A3401: Technical Documentation and 3D-modelling, 6 cp
YmDSaEnergy: Global Energy Revolution, 20 - 30 cp
Obligatory Studies 23 ECTS cr. If the required prerequisites in the course BL20A1600 Smart Grids 5 ECTS cr aren't fulfilled, students are recommended to choose either BL10A8400 Solar Economy and Smart Grids 3 ECTS cr (LUT Summer School course) or BL40A2301 Energy Efficiency 6 ECTS cr.
BL20A1300: Energy Resources, 6 cp
BL20A1400: Renewable Energy Technology, 6 cp
BL20A1500: Energy Scenarios, 6 cp
BL20A1600: Smart Grids, 5 cp

Course descriptions

Descriptions of courses and study modules included in the degree structures

YmDSustaDD: Sustainability Science and Solutions, Double Degree, 40 - 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 60 ECTS cr

BH60A5000: Master's Thesis, 30 cp

Validity: 01.08.2015 -
Form of study: Basic studies
Type: Master's Thesis
Unit: LUT School of Energy Systems

Teachers: Risto Soukka

Year:

M.Sc. (Tech.) 2

Period:

1-4

Teaching Language:

English

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. define a research problem,
2. choose and apply research methods relevant to the research problem,
3. search for suitable reference material, and assess the quality and reliability of the material and the information it contains,
4. use and interpret reference material correctly and diversely,
5. report on his or her work in writing, taking into account language and layout requirements, and
6. give a concise oral presentation on the content and results of the work.

Contents:

The thesis is a research or a planning project. Students must demonstrate the ability to complete the project independently and following a plan. A report is prepared following the instructions for the Master's thesis.

Teaching Methods:

The presentation of the thesis will be arranged with the supervising professor. There will not be a separate seminar. Total workload approx. 780 h.

Assessment:

0 - 5. Master's Thesis 100 %.

Related to:

to sustainability

BH60A4600: Introduction to M.Sc. Studies, 1 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, Sanni Väisänen, Aki-Pekka Grönman, Katja Hynynen, Marjaana Lehtinen

Note:

A student, who has already done the course BH60A3900 Johdatus ympäristötekniikan opiskeluun, doesn’t have to take this course.

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

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. describe the content of the Degree Programme, interpret the study guide and also describe the research areas of School of Energy Systems,
2. prepare his/her individual study plan (ePSP) and follow the progress of his/her studies with the help of WebOodi's personal study plan,
3. observe the university's examination practices and degree programme practices (incl. instructions of the Master's Thesis),
4. use the services of the library, retrieve information independently and use the information sources in accordance with good practices, and also to observe the copyrights,
5. understand how to manage the studies and how to find help when needed during his/her studies, and
6. use the Moodle learning environment.

Contents:

1st period: Lectures together with all students of International Master's programs in Energy Technology, Electrical Engineering and Sustainability Science and Solutions. Getting to know the School of Energy Systems and the Master's programs Studies (incl. Master's Thesis). Study and exam culture in LUT. LUT library collections, databases, reference practices, and copyrights. ePSP workshop. Research areas of School of Energy Systems. The course is related to sustainability.

Teaching Methods:

1st period: 12 h of obligatory lectures (incl. participation in an ePSP workshop and library visit). 2nd period: Individual discussion with a teacher tutor 0,5 h. Individual work (total approx. 13 h): 1st period: An individual study plan. Assignments of information searching, library use, and databases on Moodle. 2nd period: Written assignment about study and career plans. Total workload 26 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:

Study Guide, Moodle, LUT library collections, and databases.

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

No

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

No

Related to:

to sustainability

BH60A0252: Solid Waste Management Technology, 7 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: Jouni Havukainen, Mika Luoranen, Mika Horttanainen

Year:

M. Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Mika Horttanainen

Aims:

Upon completion of the course the student is expected to be able to
1. explain the most important generation mechanisms, properties, and collection and treatment systems of solid waste,
2. explain the operation of essential process technology and equipment,
3. compare and give grounded proposals for treatment methods and processes applicable to different situations,
4. calculate process parameters related to composting, digestion and energy utilization,
5. apply waste management legislation,
6. apply what he/she has learned to the environmental treatment and utilization of waste, and
7. describe the operation of regional waste management.

Contents:

Generation of solid waste and waste management in different parts of the world, properties of waste, legislation concerning waste management, source separation, collection and transport, pretreatment, composting, anaerobic digestion, waste-to-energy, landfilling, regional waste management, treatment of polluted soil.

Teaching Methods:

1st period: 14 h of lectures, 10 h of tutorials. 2nd period: 12 h of lectures, 8 h of tutorials. Assignment with literature and calculation part, presentation, individual work approx. 82 h. Field trip approx. 12 h. Lecture assignments approx. 10 h. Examination and preparation for it approx. 30 h. Total workload 182 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Examination 60 %, assignment 30 %, lecture assignments 10 %.

Course Materials:

Tchobanoglous, Theisen, Vigil: Integrated Solid Waste Management, 1993. Handouts provided by the lecturer, course environment on Moodle.

Prerequisites:

BH60A0000 Ympäristötekniikan perusteet, BH60A0901 Ympäristömittaukset or equivalent knowledge

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

Yes, 15

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 instruction.

Related to:

sustainability

BH60A0451: Air Pollution Control, 6 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: Ville Uusitalo, Risto Soukka

Note:

Replaces the course BH60A0450 Kaasumaisten päästöjen hallinta.

Year:

M.Sc. (Tech.) 1-2

Period:

1-2

Teaching Language:

English

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. comprehend the air pollution control terminology,
2. apply methods for improving air quality in cities,
3. apply methods for decreasing the carbon footprint of products and services,
4. control air pollution treatment methods economically in changing conditions,
5. calculate reduction costs for air pollution,
6. apply different risk assessment methods,
7. comprehend the formation and treatment methods of air pollution,
8. comprehend air pollution control technologies and processing systems, and
9. comprehend sustainability aspect of air pollution control

Contents:

Control of particulates, sulphur and nitrogen oxides, greenhouse gas emissions, and of other gaseous emissions. Risk assessment methods. Sustainability aspects.

Teaching Methods:

14 h of lectures, 1st - 2nd period. 20 h of lectures, 1st - 2nd period. Option for study trip 8 h. Independent work (approx. 114 h): Assignment, approx.. 60 h, Examination and preparation for it, approx. 54 h. Total workload 156 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Examination 50 %, assignment 50 %.

Course Materials:

De Nevers Noel: Air Pollution Control Engineering Cooper: Air Pollution Control - A Design Approach. Moodle.

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

Yes, 1-5

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

BH60A0652: Sustainable Water Use, 6 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: Heli Kasurinen, Risto Soukka

Note:

Replaces the course BH60A0651 Vedenkäytön kestävyyden hallinta.

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

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. define the key concepts of water pollution control,
2. explain the operation of essential process technology and equipment related to the control of water pollution,
3. compare and give grounded proposals for treatment methods and processes applicable to different situations,
4. apply legislation and official regulations related to water pollution control and sludge treatment,
5. apply means to protect groundwater,
6. apply means to reduce the environmental load of surface waters,
7. describe the key factors that can affect the water footprint,
8. describe the measures for the environmentally friendly management of by-product flows, and
9. compare the economic efficiency of different wastewater treatment methods.

Contents:

Sustainability challenges of water use. Water supply, water use in different sectors and loading of water systems. Wastewater treatment in industry and municipalities. Sludge treatment. Production of drinking water. Protection of groundwater deposits.

Teaching Methods:

1st - 2nd period: 14 h of lectures. 1st - 2nd period: 20 h of tutorials. Assignment approx. 60 h. Field trip approx. 8 h. Examination and preparation for it approx. 54 h. Total workload 156 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Examination 50 %, assignment 50 %.

Course Materials:

Tchobanoglous: Wastewater Engineering. Treatment and Reuse, 2003. Handouts provided by the lecturer, course environment on Moodle.

Prerequisites:

BH60A0000 Ympäristötekniikan perusteet or equivalent knowledge.

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

BH60A4700: Climate Finance and Carbon Markets, 3 cp

Validity: 01.08.2014 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Virgilio Panapanaan, Lassi Linnanen

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Econ. & Bus. Adm.), M.Sc. (Tech.) Lassi Linnanen, D.Sc. (Tech.) Virgilio Panapanaan

Aims:

1. to know and understand the new global negotiation, agreement and policy on climate change;
2. to understand and explain the global climate finance and its role in mitigation and

adaptation;
3. to learn the principles of emission trading and explain its role in the carbon markets inside and outside Europe;
4. to gain insights on the emergence and formation of carbon markets worldwide; and
5. and to explain the impacts of an emission trading scheme on different sectors/stakeholders.

Contents:

Topics include: Global climate finance and the new climate agreements, climate finance architecture, actors and instruments, mitigation and adaptation climate financing in developing countries, carbon markets and different emerging carbon trading schemes, EU emission trading scheme, and the impacts of climate finance and emission trading.

Teaching Methods:

3rd period: 14 h of lectures 4th period: Assignment and seminar. Examination. Independent study (approx. 66 h): assignment 24 h, examination and preparation for it 36 h, seminars 4 h. Total workload 78 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 %, assignment 30 %.

Course Materials:

Will be announced during the course.

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

Yes, unlimited.

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

BH60A2101: Advanced Course in Life Cycle Assessment, 7 cp

Validity: 01.08.2010 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Risto Soukka, Ivan Deviatkin, Sanni Väisänen

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

YmDCore: Core Studies, 20 - 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 23-27 ECTS cr

BH60A2101: Advanced Course in Life Cycle Assessment, 7 cp

Validity: 01.08.2010 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Risto Soukka, Ivan Deviatkin, Sanni Väisänen

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

BH60A2701: Energy Efficient Environment, 6 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: Risto Soukka, Mika Luoranen

Year:

M.Sc. (Tech.) 2

Period:

3-4

Teaching Language:

English

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. assess energy related factors that affect areal planning,
2. compare factors that affect the sustainability of energy solutions for individual buildings and areas, and
3. plan and execute a procedure for comparing relevant energy aspects of competing energy supply alternatives for a housing area.

Contents:

The lectures deal with the following topic areas: areal planning, legal and economic control factors, planning of areal energy consumption, low energy buildings, areal energy supply and environmental performance criteria. Students will complete an assignment based on the principles of life-cycle modelling.

Teaching Methods:

3rd period: 14 h of lectures
3rd - 4th period: Assignment. Independent work: individual assignment (approx. 128 h). Examination and preparation for it (approx. 40 h). Total workload 182 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Examination 50 %, assignment 50 %.

Course Materials:

Lecture material, Moodle.

Prerequisites:

BH60A2101 Advanced Course in Life Cycle Assessment attended.

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

Yes, 5

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

Yes, 5

BH60A3001: Corporate Responsibility and Management 2, 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: Anna Kuokkanen, Lassi Linnanen, Mirja Mikkilä

Note:

Replaces the course BH60A3000 Yritysvastuu ja johtaminen.

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Econ. & Bus. Adm.), M.Sc. (Tech.) Lassi Linnanen, Associate Professor, D.Sc. (Agr. & For.) Mirja Mikkilä

Aims:

Upon the completion of the course the student is expected to be able to:
1. to analyze decision making situations related to corporate responsibility,
2. to propose solutions to challenging business situation related corporate responsibility,
3. to evaluate critically corporate responsibility communication,
4. to discuss and argument on various perspectives of corporate responsibility based on the learned issues and on-going societal debate.
5. to carry out self- and peer evaluations

Contents:

Familiarization with the strategic responsibility framework of a firm. Reorganization of dimensions of responsible business. Deepening the application skills of mechanisms and tools of corporate responsibility. Analysis of business and financial consequences of responsibility governance. Familiarization of basics of business ethics. Communication and reporting of goals and implementation of corporate responsibility to stakeholders. Learning of corporate responsibility reporting guidelines.

Teaching Methods:

Lectures 6 h, 3 period. Written report on Corporate Responsibility communication and preparation of seminar presentation, pair work approximately 22 h, written report 3 period. Seminar presentation 4. period. Case-assignments, group work, approximately 62 h, 4 period. The student must participate in the case-assignments.
Learning diary, approximately 22 h, 3.-4. period. Total workload 134 h, of which independent work approximately 106 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Evaluation 0 - 5. Written report 25 %, Case-assignments 50%, learning diary 25 %.

Course Materials:

1. Caset: Hamschmidt, Jost (toim.): Case studies in sustainability management and strategy: the Oikos collection, 2007. 2. Pirson, Michael (toim.): Case studies in social entrepreneurship: the Oikos collection, 2015. 3. GRI yhteiskuntavastuun raportointiohjeisto, versiot 3.1 ja 4. Further course material will be announced during the lectures. Course material in Moodle.

Prerequisites:

BH60A2900 Yritysvastuu ja johtaminen 1 or BH60A4500 Corporate responsibility and management 1 passed

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

Yes, 5 students. See Prerequisites.

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

Yes, 5 students. See Prerequisites

BH60A3501: Sustainable Innovation and System Transition, 5 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: Lassi Linnanen, Mirja Mikkilä

Year:

M.Sc. (Tech.) 1

Period:

1-3

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Econ. & Bus. Adm.), M.Sc. (Tech.) Lassi Linnanen, Associate Professor, D.Sc. (Agr. & For.) Mirja Mikkilä

Aims:

Upon the completion of the course the student is expected to be able to:
1. discuss the concept of sustainable innovation and system transition
2. analyze complex sustainability challenges, and develop solutions that fill all aspects of sustainability, and
3. work in a multicultural group and produce a scientific written report and a seminar presentation about his findings.

Contents:

Sustainability and innovation, system innovation and transition. Practice based innovation, innovation processes and networks. The student writes a learning diary with which he/she reflects the content of the course, his/her personal learning and the progress of the project work. The students produce a large project work in groups on the basis of a real life case example or a literature review. The course themes are both from developing and developed country settings.

Teaching Methods:

1st period: 18 h of lectures, independent work approx. 9 h (preassignment and learning diary).2nd period: 8 h of tutorials, independent work approx. 42 h (project work, learning diary).3rd period: 5 h of tutorials, 6 h of seminars, independent work approx. 42 h (project work, learning diary).Total: Lectures and tutorials 31 h, lecture diary 20 h, project work 70 h and seminar presentation 6 h. Total workload 130 h, of which independent work approximately 93 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Lecture diary 20 %, project work and seminars 80 %.

Course Materials:

Course material will be announced during the lectures. Moodle.

Prerequisites:

B.Sc. studies or corresponding knowledge.

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

Yes, 5 students. See Prerequisites

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

Yes, 5 students. See Prerequisites

Related to:

to sustainability

Students, who haven´t done Johdatus ympäristötekniikan opiskeluun, are required to do Introduction to M.Sc. Studies

BH60A4600: Introduction to M.Sc. Studies, 1 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, Sanni Väisänen, Aki-Pekka Grönman, Katja Hynynen, Marjaana Lehtinen

Note:

A student, who has already done the course BH60A3900 Johdatus ympäristötekniikan opiskeluun, doesn't have to take this course.

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

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. describe the content of the Degree Programme, interpret the study guide and also describe the research areas of School of Energy Systems,
2. prepare his/her individual study plan (ePSP) and follow the progress of his/her studies with the help of WebOodi's personal study plan,
3. observe the university's examination practices and degree programme practices (incl. instructions of the Master's Thesis),
4. use the services of the library, retrieve information independently and use the information sources in accordance with good practices, and also to observe the copyrights,
5. understand how to manage the studies and how to find help when needed during his/her studies, and
6. use the Moodle learning environment.

Contents:

1st period: Lectures together with all students of International Master's programs in Energy Technology, Electrical Engineering and Sustainability Science and Solutions. Getting to know the School of Energy Systems and the Master's programs Studies (incl. Master's Thesis). Study and exam culture in LUT. LUT library collections, databases, reference practices, and copyrights. ePSP workshop. Research areas of School of Energy Systems. The course is related to sustainability.

Teaching Methods:

1st period: 12 h of obligatory lectures (incl. participation in an ePSP workshop and library visit). 2nd period: Individual discussion with a teacher tutor 0,5 h. Individual work (total approx. 13 h): 1st period:

An individual study plan. Assignments of information searching, library use, and databases on Moodle. 2nd period: Written assignment about study and career plans. Total workload 26 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:

Study Guide, Moodle, LUT library collections, and databases.

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

No

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

No

Related to:

to sustainability

Students, who haven´t done Yritysvastuu ja johtaminen 1, are required to do Corporate Responsibility and Management 1.

BH60A4500: Corporate Responsibility and Management 1, 3 cp

Validity: 01.06.2013 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Lassi Linnanen, Mirja Mikkilä

Note:

The course is intended for international students or Sustainability minor students. Literature examination in the electric exam system. Registration for the course in WebOodi during the academic year. Registration for the exam using the electric exam software (Exam). The examination can be carried also during the vacations. Beyond the academic year the registration only for the electric exam software. Moodle is used as a communication platform.

Year:

B.Sc. (Tech.) 3

Period:

1-4 Calendar year

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Econ. & Bus. Adm.), M.Sc. (Tech.) Lassi Linnanen, Associate Professor D.Sc. (Agr.& For.) Mirja Mikkilä

Aims:

Upon completion of the course the student is expected to be able to:
1. recognize the relationship between the company and society,
2. explain the connection between corporate responsibility and business strategies,
3. recognize organizational, economic, and social issues related to corporate social responsibility,
4. identify tools and mechanisms of corporate responsibility,
5. name dimensions and stakeholders related to corporate responsibility,
6. explain the importance of stakeholders in his/her own words.

Contents:

Corporate environmental strategies and application of the methods of environmental management. Analyzing the impacts that environmental management has on business. Identifying the sectors of responsible business operations. Basics of corporate ethics. Informing of and reporting on corporate responsibility issues to the stakeholders. Reporting of corporate social responsibility. The course is related to sustainability.

Teaching Methods:

Literature examination in the exam aquarium. All the exams done during one calendar month are to be reviewed by the 15th of the following month. Total workload 78 h. See Moodle for further instructions and contact information.

Assessment:

0 - 5. Examination 100 %.

Course Materials:

Werther, William B. Jr., Chandler, David: Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, 2010. Other material and literature specified in MOODLE course overview.

Prerequisites:

BH60A1600 Basic Course on Environmental Management and Economics attended or equivalent knowledge.

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

The course has 1-5 places for the exchange students.

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

YmDSusta: Sustainability Science and Solutions, 40 - 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

BH60A5000: Master's Thesis, 30 cp

Validity: 01.08.2015 -
Form of study: Basic studies
Type: Master's Thesis
Unit: LUT School of Energy Systems

Teachers: Risto Soukka

Year:

M.Sc. (Tech.) 2

Period:

1-4

Teaching Language:

English

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. define a research problem,
2. choose and apply research methods relevant to the research problem,
3. search for suitable reference material, and assess the quality and reliability of the material and the information it contains,
4. use and interpret reference material correctly and diversely,
5. report on his or her work in writing, taking into account language and layout requirements, and
6. give a concise oral presentation on the content and results of the work.

Contents:

The thesis is a research or a planning project. Students must demonstrate the ability to complete the project independently and following a plan. A report is prepared following the instructions for the Master's thesis.

Teaching Methods:

The presentation of the thesis will be arranged with the supervising professor. There will not be a separate seminar. Total workload approx. 780 h.

Assessment:

0 - 5. Master's Thesis 100 %.

Related to:

to sustainability

BH60A0252: Solid Waste Management Technology, 7 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: Jouni Havukainen, Mika Luoranen, Mika Horttanainen

Year:

M. Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Mika Horttanainen

Aims:

Upon completion of the course the student is expected to be able to
1. explain the most important generation mechanisms, properties, and collection and treatment systems of solid waste,
2. explain the operation of essential process technology and equipment,
3. compare and give grounded proposals for treatment methods and processes applicable to different situations,
4. calculate process parameters related to composting, digestion and energy utilization,
5. apply waste management legislation,
6. apply what he/she has learned to the environmental treatment and utilization of waste, and
7. describe the operation of regional waste management.

Contents:

Generation of solid waste and waste management in different parts of the world, properties of waste, legislation concerning waste management, source separation, collection and transport, pretreatment, composting, anaerobic digestion, waste-to-energy, landfilling, regional waste management, treatment of polluted soil.

Teaching Methods:

1st period: 14 h of lectures, 10 h of tutorials. 2nd period: 12 h of lectures, 8 h of tutorials. Assignment with literature and calculation part, presentation, individual work approx. 82 h. Field trip approx. 12 h. Lecture assignments approx. 10 h. Examination and preparation for it approx. 30 h. Total workload 182 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Examination 60 %, assignment 30 %, lecture assignments 10 %.

Course Materials:

Tchobanoglous, Theisen, Vigil: Integrated Solid Waste Management, 1993. Handouts provided by the lecturer, course environment on Moodle.

Prerequisites:

BH60A0000 Ympäristötekniikan perusteet, BH60A0901 Ympäristömittaukset or equivalent knowledge

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

Yes, 15

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 instruction.

Related to:

sustainability

BH60A0451: Air Pollution Control, 6 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: Ville Uusitalo, Risto Soukka

Note:

Replaces the course BH60A0450 Kaasumaisten päästöjen hallinta.

Year:

M.Sc. (Tech.) 1-2

Period:

1-2

Teaching Language:

English

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. comprehend the air pollution control terminology,
2. apply methods for improving air quality in cities,
3. apply methods for decreasing the carbon footprint of products and services,
4. control air pollution treatment methods economically in changing conditions,
5. calculate reduction costs for air pollution,
6. apply different risk assessment methods,
7. comprehend the formation and treatment methods of air pollution,
8. comprehend air pollution control technologies and processing systems, and
9. comprehend sustainability aspect of air pollution control

Contents:

Control of particulates, sulphur and nitrogen oxides, greenhouse gas emissions, and of other gaseous emissions. Risk assessment methods. Sustainability aspects.

Teaching Methods:

14 h of lectures, 1st - 2nd period. 20 h of lectures, 1st - 2nd period. Option for study trip 8 h. Independent work (approx. 114 h): Assignment, approx.. 60 h, Examination and preparation for it, approx. 54 h. Total workload 156 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Examination 50 %, assignment 50 %.

Course Materials:

De Nevers Noel: Air Pollution Control Engineering Cooper: Air Pollution Control - A Design Approach. Moodle.

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

Yes, 1-5

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

BH60A0652: Sustainable Water Use, 6 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: Heli Kasurinen, Risto Soukka

Note:

Replaces the course BH60A0651 Vedenkäytön kestävyyden hallinta.

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

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. define the key concepts of water pollution control,
2. explain the operation of essential process technology and equipment related to the control of water pollution,
3. compare and give grounded proposals for treatment methods and processes applicable to different situations,
4. apply legislation and official regulations related to water pollution control and sludge treatment,
5. apply means to protect groundwater,
6. apply means to reduce the environmental load of surface waters,
7. describe the key factors that can affect the water footprint,
8. describe the measures for the environmentally friendly management of by-product flows, and
9. compare the economic efficiency of different wastewater treatment methods.

Contents:

Sustainability challenges of water use. Water supply, water use in different sectors and loading of water systems. Wastewater treatment in industry and municipalities. Sludge treatment. Production of drinking water. Protection of groundwater deposits.

Teaching Methods:

1st - 2nd period: 14 h of lectures. 1st - 2nd period: 20 h of tutorials. Assignment approx. 60 h. Field trip approx. 8 h. Examination and preparation for it approx. 54 h. Total workload 156 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Examination 50 %, assignment 50 %.

Course Materials:

Tchobanoglous: Wastewater Engineering. Treatment and Reuse, 2003. Handouts provided by the lecturer, course environment on Moodle.

Prerequisites:

BH60A0000 Ympäristötekniikan perusteet or equivalent knowledge.

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

BH60A1201: Indoor Climate Management of Buildings, 7 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 Luoranen, Mihail Vinokurov, Jarkko Mäki

Note:

Replaces the course BH60A1200 Ilmanvaihto- ja ilmastointitekniikka.

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Associate professor, D.Sc. (Tech.) Mika Luoranen

Aims:

Upon completion of the course the student is expected to be able to:
1. identify and assess factors that affect the design of ventilation systems
2. assess systems that meet the ventilation requirements of different facilities and choose the applicable ventilation system
3. assess the energy efficiency of ventilation
4. recognize and apply special regulations in the field
5. calculate and design a ventilation system for a public facility
6. use (the most recent) CAD programmes, and
7. apply what he/she has learned to practical design work.

Contents:

The criteria and quantity of ventilation in different facilities. Ventilation systems for buildings. Air distribution and air flows in rooms. Air treatment processes: mixing, heating, cooling, humidifying, filtration. Energy economics of ventilation. Heat recovery systems. Control of air conditioning systems. Use of the most recent CAD programmes.

Teaching Methods:

1st period: 14 h of lectures, 7 h of calculation tutorials, 14 h of CAD tutorials, 1 h introduction to laboratory work.
2nd period: 14 h of CAD tutorials, 2 h of laboratory measurements. The assignment consists of a literature, calculation and CAD part. The assignment will be completed individually. Independent work, approximately 130 h: Assignment (mostly carried out in connection with the CAD tutorials). Laboratory assignment. Examination and preparation for it. Total workload 182 h.

Assessment:

0 - 5. Examination 40 %, assignments 30 %, laboratory assignment 30 %.

Course Materials:

Study materials: Course material in Moodle.

Prerequisites:

BH20A0800 Engineering thermodynamics attended.

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

BH60A4700: Climate Finance and Carbon Markets, 3 cp

Validity: 01.08.2014 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Virgilio Panapanaan, Lassi Linnanen

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Econ. & Bus. Adm.), M.Sc. (Tech.) Lassi Linnanen, D.Sc. (Tech.) Virgilio Panapanaan

Aims:

1. to know and understand the new global negotiation, agreement and policy on climate change;
2. to understand and explain the global climate finance and its role in mitigation and adaptation;
3. to learn the principles of emission trading and explain its role in the carbon markets inside and outside Europe;
4. to gain insights on the emergence and formation of carbon markets worldwide; and
5. and to explain the impacts of an emission trading scheme on different sectors/stakeholders.

Contents:

Topics include: Global climate finance and the new climate agreements, climate finance architecture, actors and instruments, mitigation and adaptation climate financing in developing countries, carbon markets and different emerging carbon trading schemes, EU emission trading scheme, and the impacts of climate finance and emission trading.

Teaching Methods:

3rd period: 14 h of lectures 4th period: Assignment and seminar. Examination. Independent study (approx. 66 h): assignment 24 h, examination and preparation for it 36 h, seminars 4 h. Total workload 78 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 %, assignment 30 %.

Course Materials:

Will be announced during the course.

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

Yes, unlimited.

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

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

YmDSaPuhTek: , 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 ECTS cr

A250A0160: Introduction to Environmental Economics, 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: Heli Arminen, Jorma Sappinen, Tiia-Lotta Pekkanen, Aino Kuitunen

Note:

Replaces course A250A0150 Kansainvälisen kaupan teoria

Year:

B.Sc. (Econ. & Bus. Adm.) 2-3

Period:

3

Teaching Language:

Finnish

Teacher(s) in Charge:

Associate Professor, D.Sc. (Econ. & Bus. Adm.) Heli Arminen

Aims:

By the end of the course, students will be able to
- name the central environmental problems and consider them from the point of view of economics
- use different methods for valuing the environment
- use simple economic models to analyze the connections between economic growth, international trade and sustainable development
- analyze the interplay of renewable and nonrenewable resources and the economy
- evaluate environmental policies from the point of view of economics.

Contents:

Core content: Economic treatment of environmental issues
Additional content: Valuing the environment, environmental policy, renewable and nonrenewable resources as well as economic growth, international trade and sustainable development
Special content: Finnish and international aspects of environmental issues

Teaching Methods:

Lectures 20 h, exercises 8 h, preparation for lectures and exercises 20 h, course assignment and Moodle exercises 62 h, preparation for written exam and exam 50 h. Total workload for student 160 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

Yes

Examination in Exam (Yes/No):

No

Assessment:

Grade 0-5, evaluation 0-100 points. Written exam 80 %, course assignment 20 %

Course Materials:

1. Hanley, N., Shogren, J. & White, B. (2013). Introduction to Environmental Economics, 2nd edition.
2. Other material handed out during lectures and exercises.

Prerequisites:

A250A0400 Microeconomics

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

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

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

CS31A0610: Life-Cycle Costing of Investment Projects, 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: Sini-Kaisu Kinnunen, Timo Kärri

Note:

Can't be included into a same degree as CS31A0603 Life-Cycle Costing of Investment Projects.

Year:

M.Sc. 1-2

Period:

1

Teaching Language:

Finnish

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Timo Kärri
M.Sc. (Tech.) Sini-Kaisu Kinnunen

Aims:

The student can prepare and evaluate investment proposals and consider requirements of sustainability during the life-cycle of projects.

Contents:

Main content: Investment proposal. Life-cycle of investment project, life-cycle costs and profits, capital costs, initial investment and working capital, classification and selection of projects, uncertainty and risks. Evaluation methods introduced: net present value, internal rate of return, return on investment, payback period, benefit-cost ratio and profitability index. Supplementary content: Investment process, timing and financing of projects, public-private partnership, life-cycle models of machine replacements, concept of real option, evaluation of projects from the perspective of sustainability.

Teaching Methods:

Lectures 26 h, exercises 10 h, micro-execises 9 h, homeworks 12 h, individual tasks 64 h, preparation for exam and exam 36 h, 1. period. Total 157 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Exam, extra points from assignments.

Course Materials:

Lecture notes (2 copies). Mott, Graham: Investment appraisal. Pitman Publishing, 1997, (196 p.). Götze U. et al: Investment appraisal - Methods and models. Springer. 2008, (341 p.)

Prerequisites:

CS31A0102 Kustannusjohtamisen peruskurssi

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

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

YmDSaSuun: , 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.

Pakolliset opinnot 22 op

BH50A0400: Water Treatment, 2 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: Esa Vakkilainen, Kari Luostarinen

Note:

Opintojaksolle ilmoittaudutaan sähköpostitse assistentille.
Suoritetaan itseopiskeluna ja Moodle-tenttinä.

Year:

B.Sc. 3

Period:

1-4

Teaching Language:

Finnish

Teacher(s) in Charge:

Professori, TkT Esa Vakkilainen, tutkimusassistentti, DI Kari Luostarinen

Aims:

Upon completion of the course the students will be able to 1. describe the production methods of the water used in power plants, 2. define the fundamental chemistry of water treatment, 3. describe the

water quality measurement methods, 4. recognise the damages and danger situations caused by the water impurities, and 5. apply the information on water treatment processes essential for energy production.

Contents:

The fundamentals of water treatment in brief. Water analytics. The production of process water and especially of makeup water for power plants. The influence of impurities on the water-steam cycle. Preservation of power plants.

Teaching Methods:

100 % online course in Moodle. Self-study: Preparation for the examination 8 h and the examination in Moodle 3 h. Material study 41 h. Total workload 52 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

Yes

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Examination in Moodle 100 %.

Course Materials:

Buecker, Brad, Fundamentals of steam generation chemistry, PennWell, 2000. Material in Moodle.

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

BH50A1800: Fundamentals of Energy Systems Planning, 6 cp

Validity: 01.08.2011 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Esa Vakkilainen

Year:

M.Sc. 2

Period:

1-2

Teaching Language:

Finnish

Teacher(s) in Charge:

Professori, TkT Esa Vakkilainen

Aims:

Upon completion of the course the students will be able to 1. use the “Systems Engineering” method for the definition of initial data in energy system projects, 2. describe the implementation phases of the energy system projects, and 3. demonstrate practical skills for the planning, management and implementation of energy system projects and for the estimation of the systems’ environmental impacts.

Contents:

Students develop their own system product (steam, wind or solar power plant) through team and project work. During the course, students apply the “Systems Engineering” method, which consists of the following: the definition of the requirements for the product, testing, validation, the assessment and comparison of alternatives, the management and specification of subentities, risk assessment, reliability analysis, the optimisation and documentation of implementation. The student assumes one of the roles for the team: project manager, technical engineer, environmental engineer, cost engineer. Project planning and execution. Cost analysis. Estimation of environmental impact. The use of computer software as a planning aid.

Teaching Methods:

1st period: 10 h of lectures and planning tutorials. 2nd period: 8 h of lectures and planning tutorials and 2+2 h of seminar. Independent study approximately: Written assignment 80 h. Presentation preparation 14 h. Studying given material 40 h. The planning assignment is carried out in a team. Total workload 156 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Written report of the planning assignment 70 %, oral presentation 30 %.

Course Materials:

Lecture notes.

Prerequisites:

Recommended: BH50A0200 Introduction to Power Plant Engineering and BH50A0800 Steam Boilers.

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

BH50A1900: Planning of Energy Systems, 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: Esa Vakkilainen

Year:

M.Sc. 2

Period:

3-4

Teaching Language:

Finnish

Teacher(s) in Charge:

Professori, TkT Esa Vakkilainen

Aims:

Upon completion of the course the students will be able to 1. describe energy system projects including the related technical dimensioning, the power plant project execution, the siting of the power plant and the minimization of the environmental impact, 2. participate in the evaluation of environmental impacts, licensing and decision making in energy system projects, 3. optimize the power plant and its components, and 4. compare factors affecting the power plant economics.

Contents:

Students continue to develop their own system product (steam, wind or solar power plant) through team and project work. During the course, students apply the “Systems Engineering” method, which consists of the following: the definition of the requirements for the product, testing, validation, the assessment and comparison of alternatives, the management and specification of subentities, risk assessment, reliability analysis, the optimisation and documentation of implementation. The student assumes one of the roles for the team: e.g. project manager, technical engineer, environmental engineer, cost engineer. Project planning and execution. Cost analysis. Estimation of environmental impact. Modelling of the power plant for the planning. The components of power plant. The dimensioning and optimisation of components. Fluid dynamic dimensioning. Thermal engineering simulation. The use of computer software as a planning aid. Documentation and public presentation of results.

Teaching Methods:

3rd period: 10 h of lectures and planning tutorials. 4th period: 8 h of lectures and planning tutorials and 2+2 h of seminar. Independent study approximately: Written assignment 50 h. Presentation preparation 14 h. Studying given material 18 h. The planning assignment is carried out in a team. 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. Written report of the planning assignment 70 %, oral presentation 30 %.

Course Materials:

Lecture notes.

Prerequisites:

BH50A1800 Energiajärjestelmien suunnittelun perusteet.

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

BH60A2401: Energy Recovery from Solid Waste, 4 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: Mika Horttanainen, Mika Luoranen

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Mika Horttanainen

Aims:

Upon completion of the course the student is expected to be able to
1. describe the properties of waste as fuel,
2. explain the most common waste-to-energy technologies and their suitability for different energy recovery applications and materials,
3. determine the waste-to-energy recovery potential of a region,
4. describe the most important flue gas emissions and their reduction technologies characteristic for the combustion of waste, and
5. analyse the role of energy recovery in municipal waste management.

Contents:

Waste-to-energy in Finland and other countries, properties of waste as a fuel, waste handling before thermal conversion, preparation of recycled fuel, mass combustion of waste, combustion of recycled fuel, gasification of waste, energy recovery in combustion of waste, emission reduction during combustion, flue gas treatment, utilisation and treatment of ash, anaerobic digestion of waste, landfill gas utilisation in energy production.

Teaching Methods:

1st period: 14 h of lectures, 14 h of exercises. 2nd period: 4 h of lectures.
2nd period: Assignment info (2 h). Group assignment including calculations, written group report (approx. 44 h). Excursion (approx. 6 h). Written examination and preparation for it, approx. 20 h. Total workload 106 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

0 - 5. Examination 50 %, practical assignment 50 %.

Course Materials:

Course book (to the appropriate extent): Niessen, W., 2002. Combustion and incineration processes. Marcel Dekker, Inc., New York. SBN: 0-8247-0629-3. Moodle.

Prerequisites:

Basic knowledge on thermodynamics, chemistry and power plant technology.

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

BK50A3401: Technical Documentation and 3D-modelling, 6 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: Raimo Suoranta, Kimmo Kerkkänen

Note:

Replaces the course BK50A3400 Tekninen dokumentointi ja 3D-mallinnus 5 op.

Year:

B.Sc. (Tech.) 1

Period:

1-3

Teaching Language:

Finnish

Teacher(s) in Charge:

University Lecturer, Lic. Sc. (Tech.) Raimo Suoranta

Aims:

After having passed the course module the student is able to:
- use 3D-modelling software (SolidWorks) in different applications of mechanical engineering and model different geometries
- to utilize the valid standards during the documentation work
- produce tolerance-based dimensioning of a product and explain what different tolerances mean
- use identification symbols of surface roughness in documents and define their meaning
- produce manufacturing documents including welding documents according to valid standards
- produce the technical documents of an assembly, recognize different machine parts and find the critical parts of the assembly to ensure the functioning of the product
- produce and select the best software and presentation style from among different alternatives to model and document a product.

Contents:

Basics of standards for technical documentation, data processing and transfer. Rules of drawing and sizing. Process charts of hydraulic systems. Process charts for the most common technical processes Manufacturing documents of a product and symbols and identifications which are used in them (identifications and symbols for tolerances, surface roughness and

welding). Manufacturability aspects. Assembly documents. 3D assembly documents. Basics of how to compare CAD software. Basics of CAD/CAM integration. Basics of how to increase the productivity of computer assisted design by utilizing parametric, wizard based and feature based modelling. Basics of product data management (PDM systems, basic facilities of CAE systems). Basics of product visualisation.

Teaching Methods:

Lectures 36 h 1.-3. period. Exercises 18 h, 1. period. Teamwork 30 h, 2.-3. period. Project work 40 h and independent work 28 h. Total workload 156 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 50 %, exercises 50 %.

Course Materials:

Course material in 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.

YmDSaEnergy: Global Energy Revolution, 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 23 ECTS cr. If the required prerequisites in the course BL20A1600 Smart Grids 5 ECTS cr aren't fulfilled, students are recommended to choose either BL10A8400 Solar Economy and Smart Grids 3 ECTS cr (LUT Summer School course) or BL40A2301 Energy Efficiency 6 ECTS cr.

BL20A1300: Energy Resources, 6 cp

Validity: 01.08.2014 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Christian Breyer, Michael Child

Note:

Suitable also for doctoral studies

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Christian Breyer

Aims:

Upon completion of the course the student will be able to: 1. Identify the constraints and potentials of all relevant energy sources in a global context. 2. Know all relevant energy conversion technologies on the basis of their energy resource. 3. Analyse the principal structure of future energy systems on the basis of energy resource characteristics. 4. Describe the special relevance of wind energy and solar energy in the ongoing energy transformation.

Contents:

The main energy resources for the current and future energy system are: crude oil, natural gas, coal, uranium, hydro power, bioenergy, solar energy, wind energy, geothermal energy, and ocean energy. These energy resources have different theoretical, technical and economic potentials as well as geographic variations in availability. The resources also differ considerably in the impact of the emissions related to the respective energy conversion technologies being relevant for the degree of sustainability. A broad variety of energy conversion technologies at different levels of maturity are used for utilizing the resources. The availability of resources and related emissions and techno-economic maturity of related energy conversion technologies provide a fundamental structure for the future energy system and the related energy transformation pathway.

Teaching Methods:

Lectures 14 h, exercises 14 h, 1st period. Lectures 14 h, exercises 14 h, 2nd period. Examination. Total workload 156 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, examination.

Course Materials:

Material handed out in class and made available on Moodle.

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

Yes

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.

BL20A1400: Renewable Energy Technology, 6 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: Michael Child, Christian Breyer

Note:

Suitable also for doctoral studies

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Christian Breyer

Aims:

Upon completion of the course the student will be able to: 1. Identify the major renewable energy (RE) conversion technologies, mainly converting resources to electricity. 2. Describe the major characteristics of the technologies, in particular applications, efficiency, economics, industrial scale and future prospects. 3. Analyse the need for storage technologies and their different fields of application based on their key technical and economic features.

Contents:

RE resources such as wind energy, solar energy, hydro power, bioenergy, geothermal energy and ocean energy can be utilized by a variety of different energy conversion technologies. The course is focused on the conversion of the resources to electricity. The RE technologies discussed in the course are: wind turbines, solar photovoltaics, solar thermal electricity generation, hydro power plants, biogas plants, solid biomass firing plants, biomass combined heat and power plants, geothermal power plants, tidal energy, wave energy and ocean current energy. The storage technologies covered comprise a general overview and in particular include battery storage, pumped hydro storage and power-to-gas technologies. All technologies are classified with respect to their applications, efficiency, maturity, economics, industrial scaling and expected relevance for the ongoing energy transformation.

Teaching Methods:

3rd period lectures 14 h, exercises 14 h. 4th period lectures 14 h, exercises 14 h, examination. Total workload 156 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, examination 100 %

Course Materials:

Material handed out in class and made available on Moodle.

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

Yes, no specific limit

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.

BL20A1500: Energy Scenarios, 6 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: Christian Breyer, Michael Child

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Christian Breyer

Aims:

Upon completion of the course the student will be able to: 1. Describe the sustainability requirements of future energy systems as the major guard rail for the energy transformation. 2. Analyse energy transformation scenarios and identify the key technologies and setups for sustainable energy progress. 3. Describe the energy transformation in all sectors, the major technologies, the required transformation period and entire system cost optimization. 4. Describe the special role of power technologies for the energy transformation. 5. Recognize the difference between standard levelized cost of energy and total societal cost of energy.

Contents:

Energy demand is an aggregate of power, heat, cooling, mobility, agriculture and industrial energy needs. The demand has to be matched with supply of energy fulfilling sustainability criteria, safety requirements and societal acceptance for the least cost. A complete set of demand curves, technical characteristics of all major technologies, current and projected technology costs and emission factors are taken into account for sustainable energy transformation pathway formulation. The special relevance of wind energy and solar photovoltaics, the increasing relevance of power technologies, the role of storage technologies and the necessity of societal cost of energy are discussed in detail. Real scenarios for Finland, Europe and the World used as references.

Teaching Methods:

1st lectures 14 h, exercises 14 h, 3rd lectures 14 h, exercises 14 h, presentation/oral examination. Total workload 156 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, presentation/oral examination 100 %

Course Materials:

Material handed out in class and made available on Moodle.

Prerequisites:

BL20A1300 Energy Resources and BL20A1400 Renewable Energy Technology (at least one of the two courses)

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

Yes

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.

BL20A1600: Smart Grids, 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: Jarmo Partanen, Jukka Lassila, Samuli Honkapuro, Tero Kaipia

Year:

M.Sc. (Tech.) 1-2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor Samuli Honkapuro, professor Jarmo Partanen, associate professor Jukka Lassila, M.Sc. Tero Kaipia

Aims:

Upon completion of the course the student will be able to 1. Label the key elements and functionalities of the smart grid system 2. Analyze the impacts of the smart grid elements on electricity distribution system and electricity markets 3. Document and present orally the results of the seminar work 4. Provide both written and oral peer review.

Contents:

Smart grid concept, demand side management, energy storages, distributed generation, electric vehicles, self-healing networks. In addition, annually changing topical subjects.

Teaching Methods:

Lectures 14 h in 3rd period. Independent seminar work. Presentation of the seminar work, peer review of a written seminar work and working as an opponent in seminar in 4th period. Course is suitable for distance learning.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, based on the evaluation of the teachers and peers. The course is evaluated based on seminar work (written and oral presentation), and student's work as a reviewer and an opponent.

Course Materials:

Study materials will be informed during lectures.

Prerequisites:

Basic knowledge of the electricity distribution and electricity markets.

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.