Catalogue report

LUT School of Energy Systems

Master's Programme in Energy Systems

Master’s Programme in Energy Systems 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 year , full-time studies of 60 ECTS per academic year.

Learning Outcomes of the Programme

After the completion of the MSc programme in Energy Systems the graduate will
• be able to demonstrate a comprehensive understanding of the important technologies, practical applications, processes and actions concerning energy generation, power systems and energy markets, and the use of energy
• have adopted the principles of life cycle thinking and sustainable development in the domain of energy and the environment
• be able to demonstrate a critical understanding of relevant theories and techniques, problem-solving skills, and the ability to use knowledge, equipment and tools independently for the design and development of practical applications
• be able to work with others in task-oriented groups, productively participating and interacting in the group
• be able to logically think through a problem and solve it, to contribute to innovative thinking, and to unambiguously communicate knowledge and solutions to the energy community and society, orally and in writing.

Bio-Energy Systems
The student will be able to manage small-scale bio-energy production projects and to do studies and design choices of small-scale energy systems. S/he will also be able to understand what is needed to use typical biomass fuels and be able to select different types of equipment e.g. steam boilers for different types of fuels. Additionally, the student will be able to take part in strategic planning at a national level to increase the use of bio-energy nationally and to understand and be able to explain the benefits and drawbacks of different bio-energy generation technologies.

Nuclear Engineering
The student will learn to utilise different numerical methods of reactor physics and thermal hydraulic safety analysis and understand the nuclear fuel cycle. S/he will also learn how to explain the design principles of nuclear reactors, nuclear steam supply systems and safety systems. Emphasis is on light water reactors, but the student will also learn the basic principles of other reactor types, including fast reactors, heavy water and gas cooled reactors.

Degree Structure

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

The MSc in Energy Systems 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:
Master's Programme in Energy Systems

Degree structures

Degree Structure

The Master's degree (120 ECTS) consists of core studies, specialisation studies, minor studies and elective studies.

The students choose to **specialise either in Bio-energy Systems or in Nuclear Engineering**. 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 (see specialisation in Nuclear Engineering for an exception to this rule).

Electives 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 (BH10A1500 Work Internship in Master's Degree, 2-10 ECTS) may be included upon application, too.

The MSc in Energy Systems 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 structures for details.

Master's Programme in Energy Systems 2017-2018

Degree structure status: published

Academic year: 2017-18

Beginning date of the academic year: 01.08.2017

Core Studies (min 24 cp)

BH60A4600: Introduction to M.Sc. Studies, 1 cp
BH60A4400: Introduction to Sustainability, 3 cp
BH50A1300: Maintenance Management, 4 cp
BH30A0302: Nuclear Power Plant Engineering, 6 cp
BH40A1700: Numerical Methods in Heat Transfer, 6 cp
BL20A0910: Technology and Society, 4 cp

Specialisation Studies (min 60 cp)

Choose one of the following specialisations: Bio-Energy Systems or Nuclear Engineering.

Bio-Energy Systems

EnDSBio: Specialisation in Bio-Energy Systems, 60 cp
- *Obligatory*
  - BH10A2000: Master's Thesis, 30 cp
  - BH40A1600: Turbomachinery in Renewable Energy, 5 cp
  - BH50A1200: Energy Systems Engineering, 6 cp
  - BH50A1500: Bioenergy Technology Solutions, 6 cp
  - BH61A0600: Bioenergy, 3 cp
  - BH50A1400: Steam Boilers, 6 cp
- *Choose enough courses to attain a min. of 60 ECTS in specialisation studies.*
  - BH50A1701: District Heating, 4 cp
  - BH70A0101: Advanced Modelling Tools for Transport Phenomena, 5 cp
  - BH70A0200: Advanced Topics in Modelling of Energy Systems, 6 cp
  - BL20A0401: Electricity Market, 5 cp
  - BH40A1800: Steam Turbines, 3 cp

Nuclear Engineering

EnDSNuclear: Specialisation in Nuclear Engineering, 60 cp
- *Master's Thesis and Diplomityö are alternative to each other.Students who have completed BSc at LUT, may do the thesis in Finnish. Students admitted directly to this MSc programme, write the thesis in English.*
  - BH10A1101: Master's Thesis, 30 cp
  - BH10A2000: Master's Thesis, 30 cp
- *Obligatory*
  - BH30A0201: Nuclear Reactor Design, 6 cp
  - BH30A1701: Nuclear Reactor Physics Methods, 3 cp
  - BH30A1801: Nuclear Reactor Physics Analyses, 3 cp
  - BH30A1901: Theoretical Nuclear Thermal Hydraulics, 3 cp
  - BH30A2001: Computational Nuclear Thermal Hydraulics, 3 cp
  - BH30A2104: Nuclear Reactor Dynamics, 2 cp
  - BH30A2200: Experimental Nuclear Thermal Hydraulics, 3 cp
  - BH40A1800: Steam Turbines, 3 cp
- *Choose enough courses to attain a min. of 60 ECTS in specialisation studies.*
  - BH30A0701: Reliability Engineering, 4 cp
  - BH40A1501: Turbulence Models, 4 cp
  - BH50A1200: Energy Systems Engineering, 6 cp
  - BH50A1400: Steam Boilers, 6 cp
  - BL20A0401: Electricity Market, 5 cp
  - BH30A0600: Radiation Protection, 3 cp

Minor (min 20 cp)

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

Electives

Choose enough courses to attain a min. of 120 ECTS in the M.Sc. degree.
Electives 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 (BH10A1500 Work Internship in Master's Degree, 2-10 ECTS) may be included upon application, too.

Master's Programme for Double Degree Students/Major in Bio-Energy Systems 2017-2018 (edited 16.6.2017))

Degree structure status: published

Academic year: 2017-18

Beginning date of the academic year: 01.08.2017

Specialisation in Bio-Energy Systems (min 60 cp)

EnDSBio: Specialisation in Bio-Energy Systems, 60 cp
- *Obligatory*
  - BH10A2000: Master's Thesis, 30 cp
  - BH40A1600: Turbomachinery in Renewable Energy, 5 cp
  - BH50A1200: Energy Systems Engineering, 6 cp
  - BH50A1500: Bioenergy Technology Solutions, 6 cp
  - BH61A0600: Bioenergy, 3 cp
  - BH50A1400: Steam Boilers, 6 cp
- *Choose enough courses to attain a min. of 60 ECTS in specialisation studies.*
  - BH50A1701: District Heating, 4 cp
  - BH70A0101: Advanced Modelling Tools for Transport Phenomena, 5 cp
  - BH70A0200: Advanced Topics in Modelling of Energy Systems, 6 cp
  - BL20A0401: Electricity Market, 5 cp
  - BH40A1800: Steam Turbines, 3 cp

Credit transfer from studies at home university (max 50 cp)

A max. of 50 ECTS of credit transfer from studies at home university can be added here. The decision on the credit transfers is made by the student's degree programme at LUT. Contact study counselling for detailed instructions.

Electives

Choose enough courses to attain a min. of 120 ECTS in the M.Sc. degree.
Electives 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 (BH10A1500 Work Internship in Master's Degree, 2-10 ECTS) may be included upon application, too.

Master's Programme for Double Degree Students/Major in Nuclear Engineering 2017-2018 (edited 16.6.2017)

Degree structure status: published

Academic year: 2017-18

Beginning date of the academic year: 01.08.2017

Specialisation in Nuclear Engineering (min 60 cp)

EnDSNuclear: Specialisation in Nuclear Engineering, 60 cp
Master's Thesis and Diplomityö are alternative to each other.Students who have completed BSc at LUT, may do the thesis in Finnish. Students admitted directly to this MSc programme, write the thesis in English.
BH10A1101: Master's Thesis, 30 cp
BH10A2000: Master's Thesis, 30 cp
Obligatory
BH30A0201: Nuclear Reactor Design, 6 cp
BH30A1701: Nuclear Reactor Physics Methods, 3 cp
BH30A1801: Nuclear Reactor Physics Analyses, 3 cp
BH30A1901: Theoretical Nuclear Thermal Hydraulics, 3 cp
BH30A2001: Computational Nuclear Thermal Hydraulics, 3 cp
BH30A2104: Nuclear Reactor Dynamics, 2 cp
BH30A2200: Experimental Nuclear Thermal Hydraulics, 3 cp
BH40A1800: Steam Turbines, 3 cp
Choose enough courses to attain a min. of 60 ECTS in specialisation studies.
BH30A0701: Reliability Engineering, 4 cp
BH40A1501: Turbulence Models, 4 cp
BH50A1200: Energy Systems Engineering, 6 cp
BH50A1400: Steam Boilers, 6 cp
BL20A0401: Electricity Market, 5 cp
BH30A0600: Radiation Protection, 3 cp

Credit transfer from studies at home university (max 50 cp)

A max. of 50 ECTS of credit transfer from studies at home university can be added here. The decision on the credit transfers is made by the student's degree programme at LUT. Contact study counselling for detailed instructions.

Electives

Choose enough courses to attain a min. of 120 ECTS in the M.Sc. degree.
Electives 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 (BH10A1500 Work Internship in Master's Degree, 2-10 ECTS) may be included upon application, too.

Courses and study modules not included in degree structures

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).

The minors taught in English at LUT in the academic year 2017-2018 are:
(check if the courses included in the chosen minor have prerequisites)
SaDSaIE Industrial Embedded Systems
SaDREE Renewable Energy and Energy Efficiency
SaDSaEDM2 Power Electronics and Electrical Drives
KoDSaManu Modern Manufacturing
KoDSaLaser Advanced Digital Laser Based Photonic Production
KoDSaMate Advanced Materials Engineering
YmDSaResp Environmental Responsibility
MaDIntM300 Technomathematics

FyDInt300 Technical Physics
MaDSaM300 Intelligent Computing
TuSOEntr Entrepreneurship, minor
TuSOMBAN Business Analytics
TiDSOSE oftware Engineering (extensive)
KaSOIbm International Business and Management.

KoDSaLaser: Advanced Digital Laser Based Photonic Production, 20 - 30 cp
Obligatory Studies 25 ECTS cr
BK30A0803: Digital Advanced Manufacturing with Lasers, 5 cp
BK30A0901: Additive Manufacturing - 3D Printing, 5 cp
BK30A1201: Laser Materials Processing, 5 cp
BK30A1300: Laser Based Manufacturing for Design, 5 cp
BK30A1400: Individual Project Work of Laser Technology, 5 cp
KoDSaMate: Advanced Materials Engineering, 20 - 30 cp
Obligatory Studies 25 ECTS cr
BK90C1900: Introduction to Materials Engineering, 4 cp
BK90C2000: Hybrid Materials, 3 cp
BK90C2100: Functional Properties of Nanomaterials, 3 cp
BK90C2200: Sustainable Manufacturing of Advanced Materials, 5 cp
BK90C2300: High Performance Products, 5 cp
BK90C2400: Project course in Material Engineering, 5 cp
TuSOMBAN: Business Analytics, 24 - 30 cp
Obligatory courses
CS38A0010: Free analytics environment R, 6 cp
CS38A0045: Marketing analytics for Business students, 6 cp
A210A0601: Information Systems in Corporate Management and Decision-making, 6 cp
Elective courses
A365A0320: Computational Data Analytics in Business Management, 6 cp
CS38A0050: Big data in business and industry, 6 cp
TuSOEntr: Entrepreneurship, minor, 20 - 35 cp
Elective studies
CS30A1372: Creative Design and Problem Solving, 6 cp
CS30A1691: Social Sustainability, 6 cp
CS34A0302: Entrepreneurship Theory, 6 cp
CS34A0401: Strategic Entrepreneurship in an Age of Uncertainty, 6 cp
CS34A0551: Business Idea Development, 6 cp
CS34A0721: Entrepreneurship, ownership and family firms, 6 cp
A330A5101SS: Creativity and Entrepreneurship in New Product Development from Silicon Valley's Perspectives, 3 cp
YmDSaResp: Environmental Responsibility, 20 - 30 cp
Obligatory Studies 22 ECTS cr
BH60A0252: Solid Waste Management Technology, 7 cp
BH60A2401: Energy Recovery from Solid Waste, 4 cp
BH60A2701: Energy Efficient Environment, 6 cp
BH60A3001: Corporate Responsibility and Management 2, 5 cp
SaDSaIE: Industrial Embedded Systems, 21 cp
Obligatory studies (23 ECTS cr)
BL40A1811: Introduction to Embedded Systems, 6 cp
BL40A1202: Digital Control Design, 6 cp
BL40A1101: Embedded System Programming, 5 cp
BL40A2810: Automation, 6 cp
MaDSaM300: Intelligent Computing, 20 cp
Obligatory Studies, 12 ECTS cr
BM40A0701: Pattern Recognition, 6 cp
BM40A1201: Digital Imaging and Image Preprocessing, 6 cp
Select enough courses to attain 20 ECTS cr together with obligatgory courses.
BM10A1100: Advanced Methods in Mathematics, Computing and Physics, 3 - 6 cp

BM20A3001: Statistical Analysis in Modelling, 5 cp
BM20A3102: Fuzzy Sets and Fuzzy Logic, 6 cp
BM20A3401: Design of Experiments, 4 cp
BM20A3602: Fuzzy Data Analysis, 6 cp
BM20A5001: Principles of Technical Computing, 4 cp
BM20A6200: Inverse Problems and Normed Spaces, 6 cp
BM40A0801: Machine Vision and Digital Image Analysis, 6 cp
BM40A0901: Computer Vision, 6 cp
BM40A1400: GPGPU Computing, 6 cp

KaSOIbm: International Business and Management, 21 - 35 cp
Obligatory courses 21 cr
A370A0401: Case-Course of Business, 6 cp
A380A0000: Cross-Cultural Issues in International Business, 6 cp
A380A0200: Promotion and Sales Management, 6 cp
A380A6050: Introduction to International Business and Planning, 3 cp
Elective 3 cr (if 24 cr minor needed)
A380A6000: Cross-Cultural Encounters, 3 cp

KoDSaManu: Modern Manufacturing, 20 - 30 cp
Obligatory Studies 25 ECTS cr
BK50A4000: Production Processes in Modern Job Shops, 5 cp
BK50A4100: Manufacturing Systems and Scheduling, 5 cp
BK50A4200: Product Flow in Job Shops, 5 cp
BK50A4300: Managing Job Shops, 5 cp
BK50A4401: Fabrication Laboratory, 5 - 10 cp

SaDSaEDM2: Power Electronics and Electrical Drives, 20 cp
Choose a min. of 20 ECTS cr)
BL30A0600: Power Electronics, 6 cp
BL30A1001: Electrical Drives, 8 cp
BL40A2810: Automation, 6 cp
Alternative to each other, choose one.
BL30A0901: Power Electronic Components, 5 cp
BL50A0600: Electromagnetic Compatibility in Power Electronics, 2 cp

SaDREE: Renewable Energy and Energy Efficiency, 20 cp
Choose a min. of 20 ECTS cr. BL10A8400 is a LUT Summer School course.
BL10A8400SS: Solar Economy and Smart Grids, 3 cp
BL20A1300: Energy Resources, 6 cp
BL20A1400: Renewable Energy Technology, 6 cp
BL20A1500: Energy Scenarios, 6 cp
BL40A2301: Energy Efficiency, 6 cp
BL40A2401: Electrical Engineering in Wind and Solar Systems, 6 cp

TiDSOSE: Software Engineering, 24 - 30 cp
Obligatory courses 18 ECTS cr
CT10A7002: Green IT and Sustainable Computing, 6 cp
CT60A5102: Models and Methods of Software Engineering, 6 cp
CT60A5300: Software Projects, Processes and Entrepreneurship, 6 cp
Elective courses, min 6 ECTS cr
CT10A7040: Code Camp, 1 - 5 cp
CT30A8910: Software as a Service: Architectures and Engineering, 6 cp
CT60A5400: Fundamentals of Game Development, 6 cp
CT60A7322: Software Business Development, 3 cp
CT60A7510: Design Patterns, 6 cp
CS30A7402: Software and Application Innovation, 6 cp

FyDInt300: Technical Physics, 20 - 26 cp
A minimum of 20 ECTS cr should be selected from the courses below.
BM30A0500: Applied Optics, 6 cp
BM30A1500: Advanced Topics in Material Science, 6 cp
BM30A1600: Microelectronics, 6 cp
BM30A1701: Physics of Semiconductor Devices, 6 cp
BM30A2100: Microelectronics Processing Technology, 2 cp

BM30A2200: Semiconductor and Superconductor Physics, 6 cp
BM30A2500: Nanophysics, 6 cp
MaDIntM300: Technomathematics, 20 cp
Choose a minimum of 20 ECTS cr
BM10A1100: Advanced Methods in Mathematics, Computing and Physics, 3 - 6 cp
BM20A3102: Fuzzy Sets and Fuzzy Logic, 6 cp
BM20A3401: Design of Experiments, 4 cp
BM20A3602: Fuzzy Data Analysis, 6 cp
BM20A5001: Principles of Technical Computing, 4 cp
BM20A5100: Scientific Computing and Numerics for PDEs, 6 cp
BM20A6200: Inverse Problems and Normed Spaces, 6 cp
BM20A6500: Simulation and System Dynamics, 6 cp

Course descriptions

Descriptions of courses and study modules included in the degree structures

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: Sanni Väisänen, Aki-Pekka Grönman, Katja Hynynen, Risto Soukka, 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

BH60A4400: Introduction to Sustainability, 3 cp

Validity: 01.08.2013 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Mirja Mikkilä, Risto Soukka, Virgilio Panapanaan

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

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

Contents:

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

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

Examination in Examination schedule (Yes/No):
Yes

Examination in Moodle (Yes/No):
No

Examination in Exam (Yes/No):
Yes

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

Course Materials:
Will be announced during lectures. Moodle.

Limitation for students? (Yes, number, priorities/Leave empty):
Yes, 80, priority is given to the students who have this course as an obligatory in their degree structure

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

Places for Open University Students?(Yes, number/No):
This course has 1-5 places for open university students. More information on the web site for open university instructions.

Related to:
to sustainability

BH50A1300: Maintenance Management, 4 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, Juha Kaikko

Year:
M.Sc. (Tech.) 2

Period:
1-2

Teaching Language:
English

Teacher(s) in Charge:
Docent, D.Sc. (Tech.) Juha Kaikko, Professor, D.Sc. (Tech.) Esa Vakkilainen

Aims:
Upon completion of the course the student will be able to 1. identify the terminology used in maintenance management, 2. explain maintenance strategies, 3. describe failure mechanisms, 4. utilize the concepts of reliability and availability, 5. describe how maintenance management is organized in power industry, and 6. use maintenance information systems.

Contents:
Terminology. Maintenance strategies and monitoring. Failure mechanisms and reliability. Organisation and functions of maintenance management. Preventive maintenance. Spare part management. Maintenance information systems.

Teaching Methods:

1st period: 12 h of lectures and case exercises. 2nd period: 6 h of lectures and case exercises. Written assignment. Written examination. Independent study approximately: Written assignment 32 h. Preparation for the examination 14 h and the examination 3 h. Studying given material 37 h. Total workload 104 h.
Examination in Examination schedule (Yes/No):
Yes
Examination in Moodle (Yes/No):
No
Examination in Exam (Yes/No):
No
Assessment:
0 - 5. Written assignment 30 %, examination 70 %.
Course Materials:
Crespo Márquez, A.: The Maintenance Management Framework: Models and Methods for Complex Systems Maintenance, Springer-Verlag, 2007. Dhillon, B.S.: Engineering Maintenance: A Modern Approach, CRC Press, 2002. Lecture notes.
Places for exchange-students? (Yes, number/No):
Yes, 5
Places for Open University Students?(Yes, number/No):
Yes, 5

BH30A0302: Nuclear Power Plant Engineering, 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: Anne Jordan, Juhani Hyvärinen

Year:
M.Sc. (Tech.) 1
Period:
3-4
Teaching Language:
English
Teacher(s) in Charge:
Professor, D.Sc. (Tech.) Juhani Hyvärinen
Aims:
Upon completion of the course the students will be able to explain the functional principles of nuclear power plants, dimension main processes and components of light water reactor plants, is aware of different reactor types, including Small Modular Reactors (SMRs), pressure tube reactors (CANDU and RBMK), and fast reactors, understands nuclear fuel cycle and related technologies, can manage nuclear waste and apply nuclear safety principles.
Contents:
Nuclear reactor as heat source. Power conversion in light water reactor power plants. Main process and safety systems of light water reactors. Other reactor types: SMRs, CANDU, RBMK, fast reactors. Nuclear fuel cycle, nuclear waste management. Nuclear safety.
Teaching Methods:
3rd period: 14 h of lectures, 14 h of tutorials, voluntary presentation 25 h, independent study 22-47 h, interim exam 3 h. 4th period: 14 h of lectures, 14 h of tutorials, assignment 25 h, independent study 22 h, interim exam 3 h. Total workload 156 h. Assignment and presentation. Two written interim exams or one written final examination. Moodle is used in this course.
Examination in Examination schedule (Yes/No):
Yes
Examination in Moodle (Yes/No):
No

Examination in Exam (Yes/No):
No
Number of mid-term examinations:
2
Assessment:
0-5. Written examination 70 %, assignment 15 % and voluntary presentation 15 %. Possible to raise the grade by tutorials.
Course Materials:
Lecture notes.
Prerequisites:
BH30A0001 Introduction to Nuclear Energy or equivalent skills. BH30A0201 Nuclear Reactor Design recommended.
Places for exchange-students? (Yes, number/No):
Yes, 10
Places for Open University Students?(Yes, number/No):
This course has 1-5 places for open university students. More information on the web site for open university instructions.

BH40A1700: Numerical Methods in Heat Transfer, 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: Teemu Turunen-Saaresti

Note:
Replaces the course BH70A0002 Numerical Method in Heat Transfer, 6 ECTS.
Suitable also for doctoral studies.
Year:
M.Sc. (Tech.) 1-2
Period:
1-2
Teaching Language:
English
Teacher(s) in Charge:
Associate professor (tenure track), D.Sc. (Tech.) Teemu Turunen-Saaresti
Aims:
This course acquaints students with the key numerical methods in heat and mass transfer and with the use of these methods. After completing this course, students will be able to solve the different kind of heat transfer and fluid dynamic problems using numerical methods. Students are also able to explain theory and limitations of studied numerical methods and they are able to form equations using the finite volume method.
Contents:
Numerical solution methods for the conservation of mass, momentum and energy. Solutions for heat conduction and convection. The finite volume method. Formulation of discretised conservation equations. The solution of equation sets. Unsteady Stability analyses. Setting boundary conditions. The basics of computational fluid dynamic simulation.
Teaching Methods:
1st period: 12 h of lectures, 12 h of exercises. 2nd period: 12 h of lectures, 12 h of exercises. Homework 24 h. Project work 72 h. Preparing for the examination 8 h. Written examination 3 h. Total workload 155 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. Written examination 50%, project work 50%.
Course Materials:
Patankar, Suhas V.: Numerical Heat Transfer and fluid flow.
Versteeg, H.K.: An introduction to Computational Fluid Dynamics, The Finite Volume Method.
Prerequisites:
BH20A0450 Heat Transfer, BH40A0000 Fluid Dynamics and BM20A5001 Principles of Technical Computing or equivalent knowledge.
Places for exchange-students? (Yes, number/No):
Yes, 5
Places for Open University Students?(Yes, number/No):
This course has 1-5 places for open university students. More information on the web site for open university instructions.

BL20A0910: Technology and Society, 4 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: Johanna Naukkarinen

Note:
Enrolment by e-mail to post-doctoral researcher Johanna Naukkarinen.
Year:
M.Sc. (Tech.) 1-2
Period:
1-4
Teaching Language:
English
Teacher(s) in Charge:
Johanna Naukkarinen, D.Sc. (Tech), Post-doctoral Researcher
Aims:
Upon completion of the course the student will be able to:
1. understand and explain the general interplay between technology and society
2. analyze the possible effects of different technologies on society
3. evaluate how the societal factors may affect the development and dissemination of different technologies
Contents:
Social and economic factors affecting the development and adoption of technologies, mechanisms of interplay between society and technology, predicting the potential impact of technology
Teaching Methods:
The completion of the course consist of completing the learning tasks in a topic related massive open online – course (MOOC) of teacher's choice and keeping a learning diary. The MOOC will be announced at the beginning of the academic year. Formal passing or a certificate on completion of the MOOC is not required, but student has to proof that all the required assignments have been sufficiently done.
Examination in Examination schedule (Yes/No):
No
Examination in Moodle (Yes/No):
No
Examination in Exam (Yes/No):
No
Assessment:

Grading on a scale 1-5
Assessment is based on the quality of MOOC learning assignment and the quality of the learning diary. More exact assessment matrix can be found on course Moodle-area.
Course Materials:
The content of the chosen MOOC
Places for exchange-students? (Yes, number/No):
No
Places for Open University Students?(Yes, number/No):
No

EnDSBio: Specialisation in Bio-Energy Systems, 60 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

BH10A2000: 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: Ahti Jaatinen-Värri

Note:
In Master’s programmes taught in English, the Master’s thesis is always prepared in English.
Year:
M.Sc. (Tech.) 2
Period:
1-4
Teaching Language:
English
Teacher(s) in Charge:
Associate professor, D.Sc. (Tech.) Ahti Jaatinen-Värri
Professors of the degree programme
Aims:
Upon completion of the course the students will be able to 1. formulate the research problem, 2. select the methods appropriate for the research problem, 3. find sources of information suitable for the research problem, and evaluate their validity and the quality and reliability of the data, 4. utilise and interpret the sources of information correctly, and 5. report the research in writing according to the scientific principles, considering the conventions used within the field of energy technology.
Contents:
The fundamentals of scientific research. Good scientific working methods when setting the research problem, selecting the research methods, and reporting the research, considering the

conventions used within the field of energy technology. The utilisation of scientific information in problem solving. Information literacy. Scientific reports. Information retrieval. Correctness of the language. Master's thesis.

Teaching Methods:

The presentation of the thesis will be arranged with the supervising professor. There will be no separate seminar.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Master's thesis 100 %.

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

No

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

No

BH40A1600: Turbomachinery in Renewable Energy, 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: Jari Backman, Aki-Pekka Grönman, Antti Uusitalo, Ahti Jaatinen-Värri

Note:

Replaces the courses BH40A1301 Power Machines in Renewable Energy and BH40A0900 Virtauskoneiden suunnittelu.

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Dc. (Tech.) Jari Backman, Associate professor, D.Sc. (Tech.) Aki Grönman, Associate professor, D.Sc. (Tech.) Ahti Jaatinen-Värri, Researcher, D.Sc. (Tech.) Antti Uusitalo

Aims:

Upon completion of the course the students are able to 1. To choose a right type of turbomachinery for each application 2. To design the main parameters of radial and axial flow turbines and radial compressors 3. To define the performance and efficiency of a turbomachine 4. To understand principles of flow theories behind design methodologies.

Contents:

Internal flows in turbomachinery, the design of an axial flow and radial flow turbines, the design of radial compressors, gas turbines, engine power plants, ORC-process and turbomachinery in it,

operation of turbomachinery. The course is affiliated on the sustainability of energy systems and based on international scientific research.

Teaching Methods:

1st period, lectures + exercises 6 hrs, Moodle quizzes 2 hrs, homework 7 h, joint PBL sessions 2 hrs, independent studies, 2nd period lectures + exercises 12 hrs, Moodle quizzes 8 hrs, homework 21 h, laboratory session 2 h, joint PBL sessions 10 hrs, independent studies. Total workload 130 hrs.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, PBL assignments 80% and moodle quizzes 20%.

Course Materials:

Material Notebook, Moodle course material: summary, exercises, quizzes.

Prerequisites:

Turbomachinery attended or ongoing.

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

Yes, 20/Updated 16.5.17/ml

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.

BH50A1200: Energy Systems Engineering, 6 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, Juha Kaikko

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Esa Vakkilainen, Docent, D.Sc. (Tech) Juha Kaikko

Aims:

Upon completion of the course the student will be able to 1. describe different types of energy production processes, 2. utilize thermodynamics and heat and mass balances in the design of small scale energy systems, 3. use a “Systems Engineering” type approach to define the design

values for energy production processes, 4. define small scale bioenergy production projects, 5. understand how plant requirements affect the planning and implementation phases of small energy systems, and 6. define economic constraints to small scale energy processes.

Contents:

History and fundamentals of thermodynamics and energy engineering. Modern problems of power plant engineering. Combined heat and power production, especially from biomass. Fundamentals of steam and gas turbines in energy production. Systems engineering. Planning and implementation of energy systems. Economic optimization of energy system projects.

Teaching Methods:

1st period: 12 h of lectures and case exercises. 2nd period: 12 h of lectures and case exercises. Written assignment, written examination. Independent study approximately: Written assignment 80 h. Preparation for the examination 16 h and the examination 3 h. Studying given material 33 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 70 %, written assignment 30 %.

Course Materials:

Lecture notes.

Prerequisites:

Understanding of basic thermodynamics.

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

Yes, 5

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

Yes, 5

BH50A1500: Bioenergy Technology Solutions, 6 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: Esa Vakkilainen

Note:

The course is suitable also for doctoral studies.

Year:

M.Sc. (Tech.) 2

Period:

2-3

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Esa Vakkilainen

Aims:

Upon completion of the course the student will be able to 1. discuss the EU bioenergy policies including the effects of carbon trading, RES and energy efficiency, 2. understand the role and limitations of bioenergy use in Europe, 3. create a strategic vision for any country to use bioenergy, 4. understand different bioenergy generation technologies, and 5. list the biofuel production technologies, and 6. Independently follow discussions around future directions of Bioenergy technology. Independent creation of large report.

Contents:

Comparison of various bioenergy visions. Technological solutions and case studies from biomass supply and biofuel refining, end-use technologies of biofuels in different sectors. Bioenergy politics.

Teaching Methods:

12 h of lectures. Group assignment. Written examination. Independent study approximately: Written assignment 48 h. Preparation for the examination 16 h + the examination 3 h. Studying given materials 77 h. 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 60 %, assignment 40 %.

Course Materials:

Lecture notes.

Prerequisites:

BH61A0600 Bioenergy.

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.

BH61A0600: Bioenergy, 3 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: Tapio Ranta

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Tapio Ranta

Aims:

Upon completion of the course the student will be able to understand the meaning of bioenergy, alternative biomass resources, supply methods, refining and end-user applications; describe the quality properties of solid biofuels and how they are measured and evaluated by using standards; and explain the meaning of sustainability in bioenergy systems.

Contents:

The role of bioenergy in the EU energy policy, incentive programmes and future plans. Raw-material sources of bioenergy, potential resources and current use. Biomass supply systems and logistics. Refined biofuel commodities, biogas and liquid biofuels. Biomass international trade. Quality properties of solid biofuels, quality measurement and standards. Sustainable bioenergy.

Teaching Methods:

1st period: 12 h of lectures. Written examination. Total workload 78 h, containing 63 h of self-study.

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:

Course Materials
Energy Visions 2050, VTT. 2009. Chapters 2, 4.4, 5.2 - 5.4. Additional material will be announced later during lectures.

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.

BH50A1400: Steam Boilers, 6 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

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor D.Sc. (Tech.) Esa Vakkilainen

Aims:

Upon completion of the course the student will be able to 1. list typical biomass fuels and their properties, 2. understand the terminology used in maintenance management, 3. understand steam generation processes, especially from biomass, 4. describe the construction of steam boilers, 5. apply different types of steam boilers using different types of fuels, and 6. realize restrictions caused by corrosion, erosion and fouling.

Contents:

Characteristics of fuels, especially of biofuels. Combustion and gasification. Design of a steam boiler and its components. CCS. Energy balances. Solving steam boiler problems by mathematical modelling and algorithmization. Operation and maintenance of boilers: corrosion, fouling, emissions.

Teaching Methods:

1st period: 12 h of lectures and case exercises. 2nd period: 12 h of lectures and case exercises. Written assignment. Independent study approximately: Written assignment 48 h. Preparation for the examination 18 h and the examination 3 h. Studying given materials 63 h. Total workload 156 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

Yes

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

Lecture notes. Teir, Sebastian: Steam Boiler Technology, 2nd ed. 2006. Vakkilainen, Esa, Steam generation from Biomass, 2016.

Prerequisites:

Recommended: BH50A1200 Energy Systems Engineering.

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.

Choose enough courses to attain a min. of 60 ECTS in specialisation studies.

BH50A1701: District Heating, 4 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Juha Kaikko, Esa Vakkilainen

Note:

Replaces the course BH50A1700 Kaukolämmitys.

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Docent, D.Sc. (Tech.) Juha Kaikko, Professor, D.Sc. (Tech.) Esa Vakkilainen

Aims:

Upon completion of the course the student will be able to 1. describe the basics of district heating in the world and in Finland, 2. explain the technical solutions of generating and delivering district heating at a detailed level, 3. dimension heat output and annual thermal energy necessary for various heating applications, 4. dimension the district heating system and its components, 5. understand and calculate various losses, 6. evaluate the basic design and use of district heating networks and heat production.

Contents:

The formation of energy demand in buildings and the consumption variation. Consumer devices, connections and energy measurement. Piping construction as well as network planning and control. Production of district heating, district heating plants and heating power plants. Cost and tariffs for district heating.

Teaching Methods:

3rd period: 10 h of lectures. Independent study 14 h. Independent calculations and online tasks 20 h. 4th period: Written assignment 48 h. Evaluating assignments 12 h. 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 assignment 60 %, independent calculations and online tasks 40 %.

Course Materials:

Koskelainen, Lasse et al.: Kaukolämmön käsikirja, Energiateollisuus, 2006. Lecture notes.

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

Yes, 5

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

Yes, 5

BH70A0101: Advanced Modelling Tools for Transport Phenomena, 5 cp

Validity: 01.08.2009 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Timo Hyppänen, Payman Jalali

Note:

Suitable also for doctoral studies.

Year:

M.Sc. (Tech.) 1-2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Timo Hyppänen, Docent, D.Sc. (Tech.) Payman Jalali

Aims:

Transport phenomena are dealing with the heat, mass and momentum transfer in engineering and science. In this course, advanced modeling tools and methods are introduced for students of energy technology and other departments with related background in heat transfer and fluid dynamics. Students will learn how the related computer packages such as FLUENT, COMSOL Multiphysics and MATLAB can be used to solve and analyze heat transfer and fluid flow problems using computational fluid dynamics (CFD). This course provides a mathematical basis for problem formulation, and coding/solving using the above-mentioned computational packages. Students will learn how to solve simple transport problems using their own codes in MATLAB. Then more complex problems will be taught to solve using COMSOL and FLUENT packages. Upon completion of this course, they will be able to start working on various topics in heat and fluid flow engineering for advanced designs or analysis.

Contents:

Introduction to ‘transport phenomena’ and related problems, feeding problems into CFD algorithms and methods (discretization of equations and domains, transforming differential equations into algebraic equations etc.), diffusion and convection equations solved by finite difference and finite volume methods, complexities due to property variation, geometry and boundary conditions, application of computational packages (such as MATLAB, FLUENT, COMSOL Multiphysics etc.) in solving transport phenomena problems.

Teaching Methods:

3rd period: 12 h of lectures, 12 h of exercises. 4th period: 12 h of lectures, 12 h of exercises. 3 - 6 homeworks and 2 projects. Total workload 130 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

0 - 5. Examination 40 %, homeworks and projects 60 %.

Course Materials:

J.D. Anderson: Computational Fluid Dynamics, McGraw-Hill, Inc. 1995. D.A. Anderson, J.C. Tannehill, R.H. Pletcher: Computational Fluid Mechanics and HeatTransfer, McGraw-Hill, Inc. 1984. J.H. Ferziger, M. Peric: Computational Methods for Fluid Dynamics, Springer-Verlag 1996. C. Hirsch: Numerical Computation of Internal and External Flows, Volume 1:

Fundamentals of Numerical Discretization, John Wiley & Sons, 1988. MATLAB user manual. FLUENT user manual.COMSOL Multiphysics manual. Moodle.

Prerequisites:

Basic knowledge on programming using MATLAB or any other language. Basic Fluid Mechanics and Heat Transfer courses passed.

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

Yes, 4.

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.

BH70A0200: Advanced Topics in Modelling of Energy Systems, 6 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: Juha Kaikko, Tero Tynjälä, Esa Vakkilainen, Juhani Vihavainen, Jouni Ritvanen, Timo Hyppänen, Teemu Turunen-Saaresti

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Docent, D.Sc. (Tech.) Jouni Ritvanen

Aims:

Upon completion of the course the student will be able to: 1. create stationary and time dependent mass, momentum and energy balances for various kinds of energy systems, 2. perform design tasks, utilize mathematical software in calculation, and analyze the characteristics of energy systems, 3. include material property definitions into mathematical software or into own code when simulating energy systems, 4. create, solve and analyze the set of stationary and time dependent balance equations using Excel and MATLAB, 5. create, solve and analyze stationary energy systems with IPSEpro software package, and 6. create, solve and analyze time dependent energy systems with APROS software package.

Contents:

Advanced problems in the modelling of energy systems needed by engineers and researchers. The course lectures provide mathematical basis for problem formulation, and exercises providing a chance to work with various computational packages.

Teaching Methods:

1st period: 14 h of lectures and 14 h of case exercises. 2nd period: 12 h of lectures, 12 h of case exercises and 4 h of seminars. Individual work: Written assignments 52 h. Seminar work 48 h. Total individual work 100 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. Written assignments 70 %, seminar work 30 %.

Course Materials:

Moodle.

Prerequisites:

BH20A0450 Heat transfer (Recommended) BH20A0800 Engineering Thermodynamics (Recommended) BH40A1451 Fluid Dynamics II (Recommended), or similar skills.

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

Yes, 10

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

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

BL20A0401: Electricity Market, 5 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: Samuli Honkapuro

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. Samuli Honkapuro

Aims:

Upon completion of the course the student will be able to: 1. describe the characteristics of the different business sectors in the Nordic electricity market, 2. explain electricity price formation, 3. explain the operation principle of the power exchange, 4. identify and describe the products of the power exchange, 5. select the right risk management method for electricity trade, 6. describe the tasks of the different parties in an electric power system in maintaining technical and commercial power balance, including demand side management

Contents:

The restructuring of the electricity markets, power exchange, electricity trade, balance management.

Teaching Methods:

28 h of lectures, 1st period. Independent studies. Written examination.

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 distributed in class.

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.

BH40A1800: Steam Turbines, 3 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: Teemu Turunen-Saaresti, Aki-Pekka Grönman, Juhani Hyvärinen

Year:

M.Sc. (Tech.) 2

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

Aki Grönman, D.Sc., Associate professor

Aims:

Upon completion of the course the students are able to: 1. Understand how the size of the turbine affects the design 2. Understand what requirements different power plants have for steam turbines and how turbines are connected to other parts of the plant 3. Understand the fundamentals of condensation in steam turbines 4. Understand the aerodynamic design principles of steam turbines.

Contents:

Influence of turbine size on the design and construction, turbines in different power plants, condensation in turbines, steam turbine aerodynamics, hood, and condenser.

Teaching Methods:

Lectures 14 hrs, exercises 14 hrs, Quizzes 8 hrs, Home assignments 14 h, Group assignment 28 h. Total workload 78 hrs.

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, Quizzes 20%, Assignments 80%.

Course Materials:

Lecture material in Moodle.

Prerequisites:

Recommended course BH40A0801 Turbomachinery or similar knowledge.

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

Yes, 25

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

Yes, 5

EnDSNuclear: Specialisation in Nuclear Engineering, 60 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.

Master's Thesis and Diplomityö are alternative to each other.Students who have completed BSc at LUT, may do the thesis in Finnish. Students admitted directly to this MSc programme, write the thesis in English.

BH10A1101: 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: Ahti Jaatinen-Värri

Year:

M.Sc. 2

Period:

1-4

Teaching Language:

Finnish

Teacher(s) in Charge:

Associate professor, D.Sc. (Tech.) Ahti Jaatinen-Värri

Aims:

Upon completion of the course the students will be able to 1. formulate the research problem, 2. select the methods appropriate for the research problem, 3. find sources of information suitable for the research problem, and evaluate their validity and the quality and reliability of the data, 4. utilise and interpret the sources of information correctly, and 5. report the research in writing

according to the scientific principles, considering the conventions used within the field of energy technology.

Contents:

The fundamentals of scientific research. Good scientific working methods when setting the research problem, selecting the research methods, and reporting the research, considering the conventions used within the field of energy technology. The utilisation of scientific information in problem solving. Information literacy. Scientific reports. Information retrieval. Correctness of the language. Master's thesis.

Teaching Methods:

The presentation of the thesis will be arranged with the supervising professor. There will be no separate seminar.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Master's thesis 100 %.

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

No

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

No

BH10A2000: 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: Ahti Jaatinen-Värri

Note:

In Master's programmes taught in English, the Master's thesis is always prepared in English.

Year:

M.Sc. (Tech.) 2

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

Associate professor, D.Sc. (Tech.) Ahti Jaatinen-Värri
Professors of the degree programme

Aims:

Upon completion of the course the students will be able to 1. formulate the research problem, 2. select the methods appropriate for the research problem, 3. find sources of information suitable for the research problem, and evaluate their validity and the quality and reliability of the data, 4. utilise and interpret the sources of information correctly, and 5. report the research in writing

according to the scientific principles, considering the conventions used within the field of energy technology.

Contents:

The fundamentals of scientific research. Good scientific working methods when setting the research problem, selecting the research methods, and reporting the research, considering the conventions used within the field of energy technology. The utilisation of scientific information in problem solving. Information literacy. Scientific reports. Information retrieval. Correctness of the language. Master's thesis.

Teaching Methods:

The presentation of the thesis will be arranged with the supervising professor. There will be no separate seminar.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Master's thesis 100 %.

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

No

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

No

Obligatory

BH30A0201: Nuclear Reactor Design, 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: Juhani Hyvärinen, Anne Jordan

Note:

This course is available only to nationals of countries that have implemented adequate nuclear non-proliferation under the rules of the International Atomic Energy Agency (IAEA).

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Juhani Hyvärinen

Aims:

Upon completion of the course the students will be able to explain physical phenome underlying nuclear reactors, design a critical nuclear reactor using diffusion theory, and perform thermal design of the reactor core.

Contents:

Interaction of radiation with matter. Nuclear reactions and their cross sections. Reactor physics, diffusion theory, a simplified criticality calculation. The design principles for the reactor core, thermal dimensioning. An overview at the nuclear power programmes of different countries.

Teaching Methods:

1st period: Lectures 28 h, tutorials 14 h, country presentation 20 h, preparation for the interim exam 13 h and interim exam 3 h. 2nd period: Lectures 14 h, tutorials 14 h, assignment 39 h, preparation for the interim exam 8 h and interim exam 3 h. Total workload 156 h. Assignment and country presentation. Two written interim exams or one written final examination. Moodle is used in this course.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Number of mid-term examinations:

2

Assessment:

0-5. Written examination 70 %, assignment and country presentation 30 %. Possible to raise the grade by tutorials.

Course Materials:

Lecture notes. Lamarsh & Baratta: Introduction to Nuclear Engineering, 3rd edition (2014), where applicable.

Prerequisites:

BH30A0001 Introduction to Nuclear Energy or equivalent skills.

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

Yes, 10

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

Yes, 5

BH30A1701: Nuclear Reactor Physics Methods, 3 cp

Validity: 01.08.2016 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Juhani Hyvärinen, Ville Rintala

Year:

M.Sc. (Tech.) 2

Period:

2

Teaching Language:

English

Teacher(s) in Charge:

M.Sc. (Tech.) Ville Rintala, Professor, D. Sc. (Tech.) Juhani Hyvärinen

Aims:

Upon completion of the course the students will be able to derive the neutron transport equation from the basic physical phenomena, understand the concepts of neutron flux and current, and use simple numerical calculation methods for the neutron flux solution with diffusion approximation.

Contents:

The transport equation for neutrons. The diffusion of neutrons. Two-group diffusion theory. The effect of a source to the neutron flux. Simple numerical methods of reactor physics.

Teaching Methods:

Lectures 14 h, tutorials 14 h, computer exercises 4 h, assignment 46 h. Total workload 78 h. Moodle is used on this course.

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, assignment 100 %.

Course Materials:

Lecture notes: Leikkonen, Reaktorifysiikka (in Finnish). Reuss: Neutron Physics. Duderstadt & Hamilton: Nuclear Reactor Analysis, as applicable. Stacey: Nuclear Reactor Physics, as applicable.

Prerequisites:

BH30A0201 Nuclear Reactor Design and BH30A2104 Nuclear Reactor Dynamics.

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.

BH30A1801: Nuclear Reactor Physics Analyses, 3 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Juhani Hyvärinen, Ville Rintala

Year:

M.Sc. (Tech.) 2

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

M.Sc. (Tech.) Ville Rintala, Professor, D.Sc. (Tech.) Juhani Hyvärinen

Aims:

Upon completion of the course the students will be able to understand the deterministic reactor physics calculation system: transport codes for fuel bundle calculations and nodal methods for the whole core calculations, design the reactor loading compliant with applicable limitations (In-Core Fuel Management), and carry out simple Monte-Carlo calculations of reactor physics.

Contents:

Calculation methods of reactor physics for reactor fuel management purposes.

Teaching Methods:

Lectures 14 h, tutorials 14 h, computer calculations 4 h, preparation for the examination 43 h, written examination 3 h. Total workload 78 h. Moodle is used on this course.

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 %. Possible to raise the grade by tutorials.

Course Materials:

Reuss: Neutron Physics, Duderstadt & Hamilton: Nuclear Reactor Analysis, Stacey: Nuclear Reactor Physics, where applicable.

Prerequisites:

BH30A0201 Nuclear Reactor Design, BH30A1701 Nuclear Reactor Physics Methods, BH30A2104 Nuclear Reactor Dynamics.

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.

BH30A1901: Theoretical Nuclear Thermal Hydraulics, 3 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Otso-Pekka Kauppinen, Juhani Hyvärinen

Year:

M.Sc. (Tech.) 1

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Juhani Hyvärinen

Aims:

Upon completion of the course the students will be able to understand one-dimensional two-phase flow, heat transfer, boiling and condensation in pipelike geometry, master the basic continuity and constitutive equations for two-phase flow, utilise the basic equations in manual calculations, understand the continuity and constitutive equations used in computer models used in the thermal-hydraulic system codes (APROS/TRACE), and will be aware of elementary multidimensional two-phase flow modelling.

Contents:

The normal use, as well as the thermal hydraulic phenomena in disturbance and accident situations, of the reactor circuit and containment of a nuclear power plant. Continuity equations, closure laws, phenomenological models for phase interactions. Two-phase flow calculations using system codes. Two-phase flow modelling in computational fluid dynamics (CFD).

Teaching Methods:

Lectures 14 h, tutorials 14 h, computer calculations 4 h, preparation for the examination 43 h, written examination 3 h. Total workload 78 h. Moodle is used on this course.

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 %. Possible to raise the grade by tutorials.

Course Materials:

Ghiaasian: Two-Phase Flow, Boiling and Condensation, where applicable. Todreas, Kazimi: Nuclear Systems I & II, where applicable. Winterton: Thermal Design of Nuclear Reactors, where applicable. Wallis: One-dimensional Two-phase flow.

Prerequisites:

BH30A0201 Nuclear Reactor Design

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

Yes, 10

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

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

BH30A2001: Computational Nuclear Thermal Hydraulics, 3 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Otso-Pekka Kauppinen, Juhani Vihavainen

Year:

M.Sc. (Tech.) 1

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

D.Sc. (Tech.) Juhani Vihavainen

Aims:

Upon completion of the course the students will understand basic equations and special features in thermal hydraulic system code modelling, is able to describe the structure of computer codes, and can use system codes introduced in this course, APROS and TRACE, to prepare simple models and to run larger models.

Contents:

Thermal hydraulic phenomena of nuclear power plant during normal operation and incident and accident situations. Calculation and modelling of a two phase flow in computer codes. Modelling of essential processes in nuclear power plants with APROS and TRACE software. Two assignments. Optionally an excursion to the training simulator of Loviisa power plant.

Teaching Methods:

Lectures 14 h, tutorials 14 h, assignment 30 h, preparation for the examination 17 h, written examination 3 h. Total workload 78 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes (updated 3.5.17)

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

Lecture materials. APROS and TRACE code manuals, as applicable. Todreas, Kazimi: Nuclear Systems I & II, as applicable.

Prerequisites:

BH30A0201 Nuclear Reactor Design and BH30A1901 Theoretical Nuclear Thermal Hydraulics.

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.

BH30A2104: Nuclear Reactor Dynamics, 2 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: Heikki Suikkanen, Juhani Hyvärinen

Year:

M.Sc. (Tech.) 1

Period:

2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Juhani Hyvärinen

Aims:

Upon completion of the course the student will be able to explain nuclear reactor kinetics and related feedback mechanisms, principles of nuclear reactor control, and principles of efficient nuclear fuel utilisation.

Contents:

Nuclear reactor dynamic response and control. Neutron sources, approach to criticality, reactivity feedbacks in critical reactors, reactivity excursions, reactor power management, reactor poisons, fuel burnup management.

Teaching Methods:

Lectures 14 h, tutorials 14 h, preparation for the examination 21 h, written examination 3 h. Total workload 52 h. Moodle in use on this course.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Examination 100 %. Possible to raise the grade by tutorials.

Course Materials:

Reuss: Neutron Physics, Part I, as applicable.

Prerequisites:

BH30A0201 Nuclear Reactor Design

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.

BH30A2200: Experimental Nuclear Thermal Hydraulics, 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: Juhani Hyvärinen, Juhani Vihavainen, Otso-Pekka Kauppinen

Note:

Suitable also for doctoral studies

Year:

M.Sc. (Tech.) 1

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Juhani Hyvärinen

Aims:

Upon completion of the course the students will be able to describe basic measurement techniques for one- and two-phase flows, understand similitude and scaling of models, understand the interaction between experiments and code calculations, describe advanced flow structure mapping techniques (e.g. wire mesh sensing, particle image velocimetry).

Contents:

Temperature, pressure, pressure drop, liquid level and flow measurement techniques. Void fraction measurement. Similitude, scaling principles. Designing experiments for computer code validation. Advanced flow structure measurement techniques.

Teaching Methods:

Lectures 14 h, tutorials 14 h, laboratory demonstrations 16 h, computer calculations 4 h, quiz 8 h, writing reports 22 h. Total workload 78 h. Moodle is in use on this course.

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. Quiz 25%, reports of laboratory works 75%.

Course Materials:

Ghiaasian: Two-Phase Flow, Boiling and Condensation, as applicable.

Prerequisites:

BH40A0701 Measurements in Energy Technology or equivalent course experience.

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.

BH40A1800: Steam Turbines, 3 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: Teemu Turunen-Saaresti, Aki-Pekka Grönman, Juhani Hyvärinen

Year:

M.Sc. (Tech.) 2

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

Aki Grönman, D.Sc., Associate professor

Aims:

Upon completion of the course the students are able to: 1. Understand how the size of the turbine affects the design 2. Understand what requirements different power plants have for steam turbines and how turbines are connected to other parts of the plant 3. Understand the fundamentals of condensation in steam turbines 4. Understand the aerodynamic design principles of steam turbines.

Contents:

Influence of turbine size on the design and construction, turbines in different power plants, condensation in turbines, steam turbine aerodynamics, hood, and condenser.

Teaching Methods:

Lectures 14 hrs, exercises 14 hrs, Quizzes 8 hrs, Home assignments 14 h, Group assignment 28 h. Total workload 78 hrs.

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, Quizzes 20%, Assignments 80%.

Course Materials:

Lecture material in Moodle.

Prerequisites:

Recommended course BH40A0801 Turbomachinery or similar knowledge.

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

Yes, 25

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

Yes, 5

Choose enough courses to attain a min. of 60 ECTS in specialisation studies.

BH30A0701: Reliability Engineering, 4 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: Juhani Hyvärinen, Elina Hujala

Note:

Harjoitukset järjestetään kahdessa ryhmässä, suomeksi ja englanniksi.
The course will be lectured every other year, next during the academic year 2018-2019.
Suitable also for doctoral studies.

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

Yes, 2018-2019.

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

M.Sc. (Tech.), M.Sc. Elina Hujala, Professor, D.Sc. (Tech.) Juhani Hyvärinen

Aims:

Upon completion of the course the students will be able to calculate the reliability parameters for separate components and simple systems, formulate and solve fault and event trees for systems, and estimate the effect of human factors.

Contents:

Introduction to reliability engineering. Boolean algebra. The reliability parameters of components. The reliability engineering structure of systems; examples from different fields. Structural functions, reliability flow charts, fault trees, event trees, minimal cut sets. The reliability parameters of systems and their determination using different methods. Damage and effect analysis. The determination of parameters and trends from flaw observations. The improvement of the usage reliability of a system. Humans as a part of systems. Common mode failures, uncertainty analysis and importance measures. The reliability of structures.

Teaching Methods:

Lectures 21 h, tutorials 14 h. 1st period. Lectures 21 h, tutorials 14 h. 2nd period. Preparation for the examination 31 h and written examination 3 h. Total workload 104 h. Moodle is used in this course.

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 %. Possible to raise the grade by tutorials.

Course Materials:

Rausand M. & Hoyland A: System Reliability Theory, Models, Statisticals Methods and Applications.

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

Yes, 10

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

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

BH40A1501: Turbulence Models, 4 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Teemu Turunen-Saaresti

Note:

Suitable also for doctoral studies

Year:

M.Sc. (Tech.) 2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Associate professor (tenure track), D.Sc. (Tech.) Teemu Turunen-Saaresti

Aims:

Upon completion of the course the student will be able to recognize the characteristics of turbulence models and to estimate the suitability of different turbulence models for various fluid mechanical problems. In addition, the student will be able to interpret the physical basis and the theory of turbulence models.

Contents:

Navier-Stokes equations, RANS equations, Reynolds stress, eddy viscosity, algebraic, one equation and two equation models. Advanced models.

Teaching Methods:

3rd period: 12 h of lectures, 12 h of tutorials. 4th period: 12 h of lectures, 12 h of tutorials. Homework 20 h, Project work 35 h Total workload 103 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:

Homework 30%, project work 70%

Course Materials:

David C. Wilcox: Turbulence models for CFD.

Prerequisites:

BH70A0001 Numerical Methods in Heat Transfer

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.

BH50A1200: Energy Systems Engineering, 6 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, Juha Kaikko

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Esa Vakkilainen, Docent, D.Sc. (Tech) Juha Kaikko

Aims:

Upon completion of the course the student will be able to 1. describe different types of energy production processes, 2. utilize thermodynamics and heat and mass balances in the design of small scale energy systems, 3. use a “Systems Engineering” type approach to define the design values for energy production processes, 4. define small scale bioenergy production projects, 5. understand how plant requirements affect the planning and implementation phases of small energy systems, and 6. define economic constraints to small scale energy processes.

Contents:

History and fundamentals of thermodynamics and energy engineering. Modern problems of power plant engineering. Combined heat and power production, especially from biomass. Fundamentals of steam and gas turbines in energy production. Systems engineering. Planning and implementation of energy systems. Economic optimization of energy system projects.

Teaching Methods:

1st period: 12 h of lectures and case exercises. 2nd period: 12 h of lectures and case exercises. Written assignment, written examination. Independent study approximately: Written assignment 80 h. Preparation for the examination 16 h and the examination 3 h. Studying given material 33 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 70 %, written assignment 30 %.

Course Materials:

Lecture notes.

Prerequisites:

Understanding of basic thermodynamics.

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

Yes, 5

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

Yes, 5

BH50A1400: Steam Boilers, 6 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

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor D.Sc. (Tech.) Esa Vakkilainen

Aims:

Upon completion of the course the student will be able to 1. list typical biomass fuels and their properties, 2. understand the terminology used in maintenance management, 3. understand steam generation processes, especially from biomass, 4. describe the construction of steam boilers, 5. apply different types of steam boilers using different types of fuels, and 6. realize restrictions caused by corrosion, erosion and fouling.

Contents:

Characteristics of fuels, especially of biofuels. Combustion and gasification. Design of a steam boiler and its components. CCS. Energy balances. Solving steam boiler problems by mathematical modelling and algorithmization. Operation and maintenance of boilers: corrosion, fouling, emissions.

Teaching Methods:

1st period: 12 h of lectures and case exercises. 2nd period: 12 h of lectures and case exercises. Written assignment. Independent study approximately: Written assignment 48 h. Preparation for the examination 18 h and the examination 3 h. Studying given materials 63 h. Total workload 156 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

Yes

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

Lecture notes. Teir, Sebastian: Steam Boiler Technology, 2nd ed. 2006. Vakkilainen, Esa, Steam generation from Biomass, 2016.

Prerequisites:

Recommended: BH50A1200 Energy Systems Engineering.

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.

BL20A0401: Electricity Market, 5 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: Samuli Honkapuro

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. Samuli Honkapuro

Aims:

Upon completion of the course the student will be able to: 1. describe the characteristics of the different business sectors in the Nordic electricity market, 2. explain electricity price formation, 3. explain the operation principle of the power exchange, 4. identify and describe the products of the power exchange, 5. select the right risk management method for electricity trade, 6. describe the tasks of the different parties in an electric power system in maintaining technical and commercial power balance, including demand side management

Contents:

The restructuring of the electricity markets, power exchange, electricity trade, balance management.

Teaching Methods:

28 h of lectures, 1st period. Independent studies. Written examination.

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 distributed in class.

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.

BH30A0600: Radiation Protection, 3 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: Juhani Hyvärinen, Elina Hujala

Note:

In the course it is possible to take the qualification of radiation safety officer.

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

Yes, 2017-2018.

Year:

M.Sc. (Tech.) 1

Period:

2

Teaching Language:

Finnish

Teacher(s) in Charge:

M.Sc.(Tech), M.Sc. Elina Hujala, Professori, D.Sc.(Tech) Juhani Hyvärinen

Aims:

Upon completion of the course the students will be able to act as a radiation protection manager as mentioned in the radiation act for sealed sources and industrial radiography.

Contents:

Lectures on radiation protection and safety.

Teaching Methods:

Lectures 28 h, tutorials 14 h, laboratory work 4 h, assignment 21 h, preparation for the examination 8 h and written examination 3 h. Total workload 78 h. Moodle is used in this course.

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 %. Possible to raise the grade by tutorials.

Course Materials:

Lecture notes. Radiation and Nuclear Safety Authority, Finland: Säteily- and ydinturvallisuus, where applicable, as well as the valid legislation and the related radiation safety regulations.

Prerequisites:

BH30A0001 Introduction to Nuclear Energy.

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

No

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

Yes, 5

EnDSBio: Specialisation in Bio-Energy Systems, 60 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

BH10A2000: 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: Ahti Jaatinen-Värri

Note:

In Master’s programmes taught in English, the Master’s thesis is always prepared in English.

Year:

M.Sc. (Tech.) 2

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

Associate professor, D.Sc. (Tech.) Ahti Jaatinen-Värri
Professors of the degree programme

Aims:

Upon completion of the course the students will be able to 1. formulate the research problem, 2. select the methods appropriate for the research problem, 3. find sources of information suitable for the research problem, and evaluate their validity and the quality and reliability of the data, 4. utilise and interpret the sources of information correctly, and 5. report the research in writing according to the scientific principles, considering the conventions used within the field of energy technology.

Contents:

The fundamentals of scientific research. Good scientific working methods when setting the research problem, selecting the research methods, and reporting the research, considering the conventions used within the field of energy technology. The utilisation of scientific information in problem solving. Information literacy. Scientific reports. Information retrieval. Correctness of the language. Master's thesis.

Teaching Methods:

The presentation of the thesis will be arranged with the supervising professor. There will be no separate seminar.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Master's thesis 100 %.

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

No

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

No

BH40A1600: Turbomachinery in Renewable Energy, 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: Jari Backman, Aki-Pekka Grönman, Antti Uusitalo, Ahti Jaatinen-Värri

Note:

Replaces the courses BH40A1301 Power Machines in Renewable Energy and BH40A0900 Virtauskoneiden suunnittelu.

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Dc. (Tech.) Jari Backman, Associate professor, D.Sc. (Tech.) Aki Grönman, Associate professor, D.Sc. (Tech.) Ahti Jaatinen-Värri, Researcher, D.Sc. (Tech.) Antti Uusitalo

Aims:

Upon completion of the course the students are able to 1. To choose a right type of turbomachinery for each application 2. To design the main parameters of radial and axial flow turbines and radial compressors 3. To define the performance and efficiency of a turbomachine 4. To understand principles of flow theories behind design methodologies.

Contents:

Internal flows in turbomachinery, the design of an axial flow and radial flow turbines, the design of radial compressors, gas turbines, engine power plants, ORC-process and turbomachinery in it, operation of turbomachinery. The course is affiliated on the sustainability of energy systems and based on international scientific research.

Teaching Methods:

1st period, lectures + exercises 6 hrs, Moodle quizzes 2 hrs, homework 7 h, joint PBL sessions 2 hrs, independent studies, 2nd period lectures + exercises 12 hrs, Moodle quizzes 8 hrs, homework 21 h, laboratory session 2 h, joint PBL sessions 10 hrs, independent studies. Total workload 130 hrs.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, PBL assignments 80% and moodle quizzes 20%.

Course Materials:

Material Notebook, Moodle course material: summary, exercises, quizzes.

Prerequisites:

Turbomachinery attended or ongoing.

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

Yes, 20/Updated 16.5.17/ml

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.

BH50A1200: Energy Systems Engineering, 6 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, Juha Kaikko

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Esa Vakkilainen, Docent, D.Sc. (Tech) Juha Kaikko

Aims:

Upon completion of the course the student will be able to 1. describe different types of energy production processes, 2. utilize thermodynamics and heat and mass balances in the design of small scale energy systems, 3. use a “Systems Engineering” type approach to define the design values for energy production processes, 4. define small scale bioenergy production projects, 5. understand how plant requirements affect the planning and implementation phases of small energy systems, and 6. define economic constraints to small scale energy processes.

Contents:

History and fundamentals of thermodynamics and energy engineering. Modern problems of power plant engineering. Combined heat and power production, especially from biomass. Fundamentals of steam and gas turbines in energy production. Systems engineering. Planning and implementation of energy systems. Economic optimization of energy system projects.

Teaching Methods:

1st period: 12 h of lectures and case exercises. 2nd period: 12 h of lectures and case exercises. Written assignment, written examination. Independent study approximately: Written assignment 80 h. Preparation for the examination 16 h and the examination 3 h. Studying given material 33 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 70 %, written assignment 30 %.

Course Materials:

Lecture notes.

Prerequisites:

Understanding of basic thermodynamics.

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

Yes, 5

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

Yes, 5

BH50A1500: Bioenergy Technology Solutions, 6 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: Esa Vakkilainen

Note:

The course is suitable also for doctoral studies.

Year:

M.Sc. (Tech.) 2

Period:

2-3

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Esa Vakkilainen

Aims:

Upon completion of the course the student will be able to 1. discuss the EU bioenergy policies including the effects of carbon trading, RES and energy efficiency, 2. understand the role and limitations of bioenergy use in Europe, 3. create a strategic vision for any country to use bioenergy, 4. understand different bioenergy generation technologies, and 5. list the biofuel production technologies, and 6. Independently follow discussions around future directions of Bioenergy technology. Independent creation of large report.

Contents:

Comparison of various bioenergy visions. Technological solutions and case studies from biomass supply and biofuel refining, end-use technologies of biofuels in different sectors. Bioenergy politics.

Teaching Methods:

12 h of lectures. Group assignment. Written examination. Independent study approximately: Written assignment 48 h. Preparation for the examination 16 h + the examination 3 h. Studying given materials 77 h. 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 60 %, assignment 40 %.

Course Materials:

Lecture notes.

Prerequisites:

BH61A0600 Bioenergy.

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.

BH61A0600: Bioenergy, 3 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: Tapio Ranta

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Tapio Ranta

Aims:

Upon completion of the course the student will be able to understand the meaning of bioenergy, alternative biomass resources, supply methods, refining and end-user applications; describe the quality properties of solid biofuels and how they are measured and evaluated by using standards; and explain the meaning of sustainability in bioenergy systems.

Contents:

The role of bioenergy in the EU energy policy, incentive programmes and future plans. Raw-material sources of bioenergy, potential resources and current use. Biomass supply systems and logistics. Refined biofuel commodities, biogas and liquid biofuels. Biomass international trade. Quality properties of solid biofuels, quality measurement and standards. Sustainable bioenergy.

Teaching Methods:

1st period: 12 h of lectures. Written examination. Total workload 78 h, containing 63 h of self-study.

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:

Course Materials
Energy Visions 2050, VTT. 2009. Chapters 2, 4.4, 5.2 - 5.4. Additional material will be announced later during lectures.

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.

BH50A1400: Steam Boilers, 6 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

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor D.Sc. (Tech.) Esa Vakkilainen

Aims:

Upon completion of the course the student will be able to 1. list typical biomass fuels and their properties, 2. understand the terminology used in maintenance management, 3. understand steam generation processes, especially from biomass, 4. describe the construction of steam boilers, 5. apply different types of steam boilers using different types of fuels, and 6. realize restrictions caused by corrosion, erosion and fouling.

Contents:

Characteristics of fuels, especially of biofuels. Combustion and gasification. Design of a steam boiler and its components. CCS. Energy balances. Solving steam boiler problems by mathematical modelling and algorithmization. Operation and maintenance of boilers: corrosion, fouling, emissions.

Teaching Methods:

1st period: 12 h of lectures and case exercises. 2nd period: 12 h of lectures and case exercises. Written assignment. Independent study approximately: Written assignment 48 h. Preparation for the examination 18 h and the examination 3 h. Studying given materials 63 h. Total workload 156 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

Yes

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

Lecture notes. Teir, Sebastian: Steam Boiler Technology, 2nd ed. 2006. Vakkilainen, Esa, Steam generation from Biomass, 2016.

Prerequisites:

Recommended: BH50A1200 Energy Systems Engineering.

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.

Choose enough courses to attain a min. of 60 ECTS in specialisation studies.

BH50A1701: District Heating, 4 cp

Validity: 01.08.2016 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Juha Kaikko, Esa Vakkilainen

Note:

Replaces the course BH50A1700 Kaukolämmitys.

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Docent, D.Sc. (Tech.) Juha Kaikko, Professor, D.Sc. (Tech.) Esa Vakkilainen

Aims:

Upon completion of the course the student will be able to 1. describe the basics of district heating in the world and in Finland, 2. explain the technical solutions of generating and delivering district heating at a detailed level, 3. dimension heat output and annual thermal energy necessary for various heating applications, 4. dimension the district heating system and its components, 5. understand and calculate various losses, 6. evaluate the basic design and use of district heating networks and heat production.

Contents:

The formation of energy demand in buildings and the consumption variation. Consumer devices, connections and energy measurement. Piping construction as well as network planning and control. Production of district heating, district heating plants and heating power plants. Cost and tariffs for district heating.

Teaching Methods:

3rd period: 10 h of lectures. Independent study 14 h. Independent calculations and online tasks 20 h. 4th period: Written assignment 48 h. Evaluating assignments 12 h. 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 assignment 60 %, independent calculations and online tasks 40 %.

Course Materials:

Koskelainen, Lasse et al.: Kaukolämmön käsikirja, Energiateollisuus, 2006. Lecture notes.

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

Yes, 5

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

Yes, 5

BH70A0101: Advanced Modelling Tools for Transport Phenomena, 5 cp

Validity: 01.08.2009 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Timo Hyppänen, Payman Jalali

Note:

Suitable also for doctoral studies.

Year:

M.Sc. (Tech.) 1-2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Timo Hyppänen, Docent, D.Sc. (Tech.) Payman Jalali

Aims:

Transport phenomena are dealing with the heat, mass and momentum transfer in engineering and science. In this course, advanced modeling tools and methods are introduced for students of energy technology and other departments with related background in heat transfer and fluid dynamics. Students will learn how the related computer packages such as FLUENT, COMSOL Multiphysics and MATLAB can be used to solve and analyze heat transfer and fluid flow problems using computational fluid dynamics (CFD). This course provides a mathematical basis for problem formulation, and coding/solving using the above-mentioned computational packages. Students will learn how to solve simple transport problems using their own codes in MATLAB. Then more complex problems will be taught to solve using COMSOL and FLUENT packages. Upon completion of this course, they will be able to start working on various topics in heat and fluid flow engineering for advanced designs or analysis.

Contents:

Introduction to ‘transport phenomena’ and related problems, feeding problems into CFD algorithms and methods (discretization of equations and domains, transforming differential equations into algebraic equations etc.), diffusion and convection equations solved by finite difference and finite volume methods, complexities due to property variation, geometry and boundary conditions, application of computational packages (such as MATLAB, FLUENT, COMSOL Multiphysics etc.) in solving transport phenomena problems.

Teaching Methods:

3rd period: 12 h of lectures, 12 h of exercises. 4th period: 12 h of lectures, 12 h of exercises. 3 - 6 homeworks and 2 projects. Total workload 130 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

0 - 5. Examination 40 %, homeworks and projects 60 %.

Course Materials:

J.D. Anderson: Computational Fluid Dynamics, McGraw-Hill, Inc. 1995. D.A. Anderson, J.C. Tannehill, R.H. Pletcher: Computational Fluid Mechanics and HeatTransfer, McGraw-Hill, Inc. 1984. J.H. Ferziger, M. Peric: Computational Methods for Fluid Dynamics, Springer-Verlag 1996. C. Hirsch: Numerical Computation of Internal and External Flows, Volume 1: Fundamentals of Numerical Discretization, John Wiley & Sons, 1988. MATLAB user manual. FLUENT user manual.COMSOL Multiphysics manual. Moodle.

Prerequisites:

Basic knowledge on programming using MATLAB or any other language. Basic Fluid Mechanics and Heat Transfer courses passed.

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

Yes, 4.

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.

BH70A0200: Advanced Topics in Modelling of Energy Systems, 6 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: Juha Kaikko, Tero Tynjälä, Esa Vakkilainen, Juhani Vihavainen, Jouni Ritvanen, Timo Hyppänen, Teemu Turunen-Saaresti

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Docent, D.Sc. (Tech.) Jouni Ritvanen

Aims:

Upon completion of the course the student will be able to: 1. create stationary and time dependent mass, momentum and energy balances for various kinds of energy systems, 2. perform design tasks, utilize mathematical software in calculation, and analyze the characteristics of energy systems, 3. include material property definitions into mathematical software or into own code when simulating energy systems, 4. create, solve and analyze the set of stationary and time dependent balance equations using Excel and MATLAB, 5. create, solve and analyze stationary energy systems with IPSEpro software package, and 6. create, solve and analyze time dependent energy systems with APROS software package.

Contents:

Advanced problems in the modelling of energy systems needed by engineers and researchers. The course lectures provide mathematical basis for problem formulation, and exercises providing a chance to work with various computational packages.

Teaching Methods:

1st period: 14 h of lectures and 14 h of case exercises. 2nd period: 12 h of lectures, 12 h of case exercises and 4 h of seminars. Individual work: Written assignments 52 h. Seminar work 48 h. Total individual work 100 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. Written assignments 70 %, seminar work 30 %.

Course Materials:

Moodle.

Prerequisites:

BH20A0450 Heat transfer (Recommended) BH20A0800 Engineering Thermodynamics (Recommended) BH40A1451 Fluid Dynamics II (Recommended), or similar skills.

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

Yes, 10

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

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

BL20A0401: Electricity Market, 5 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: Samuli Honkapuro

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. Samuli Honkapuro

Aims:

Upon completion of the course the student will be able to: 1. describe the characteristics of the different business sectors in the Nordic electricity market, 2. explain electricity price formation, 3. explain the operation principle of the power exchange, 4. identify and describe the products of the power exchange, 5. select the right risk management method for electricity trade, 6. describe the tasks of the different parties in an electric power system in maintaining technical and commercial power balance, including demand side management

Contents:

The restructuring of the electricity markets, power exchange, electricity trade, balance management.

Teaching Methods:

28 h of lectures, 1st period. Independent studies. Written examination.

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 distributed in class.

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.

BH40A1800: Steam Turbines, 3 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: Teemu Turunen-Saaresti, Aki-Pekka Grönman, Juhani Hyvärinen

Year:

M.Sc. (Tech.) 2

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

Aki Grönman, D.Sc., Associate professor

Aims:

Upon completion of the course the students are able to: 1. Understand how the size of the turbine affects the design 2. Understand what requirements different power plants have for steam turbines and how turbines are connected to other parts of the plant 3. Understand the fundamentals of condensation in steam turbines 4. Understand the aerodynamic design principles of steam turbines.

Contents:

Influence of turbine size on the design and construction, turbines in different power plants, condensation in turbines, steam turbine aerodynamics, hood, and condenser.

Teaching Methods:

Lectures 14 hrs, exercises 14 hrs, Quizzes 8 hrs, Home assignments 14 h, Group assignment 28 h. Total workload 78 hrs.

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, Quizzes 20%, Assignments 80%.

Course Materials:

Lecture material in Moodle.

Prerequisites:

Recommended course BH40A0801 Turbomachinery or similar knowledge.

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

Yes, 25

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

Yes, 5

EnDSNuclear: Specialisation in Nuclear Engineering, 60 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.

Master's Thesis and Diplomityö are alternative to each other.Students who have completed BSc at LUT, may do the thesis in Finnish. Students admitted directly to this MSc programme, write the thesis in English.

BH10A1101: 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: Ahti Jaatinen-Värri

Year:

M.Sc. 2

Period:

1-4

Teaching Language:

Finnish

Teacher(s) in Charge:

Associate professor, D.Sc. (Tech.) Ahti Jaatinen-Värri

Aims:

Upon completion of the course the students will be able to 1. formulate the research problem, 2. select the methods appropriate for the research problem, 3. find sources of information suitable for the research problem, and evaluate their validity and the quality and reliability of the data, 4. utilise and interpret the sources of information correctly, and 5. report the research in writing according to the scientific principles, considering the conventions used within the field of energy technology.

Contents:

The fundamentals of scientific research. Good scientific working methods when setting the research problem, selecting the research methods, and reporting the research, considering the conventions used within the field of energy technology. The utilisation of scientific information in problem solving. Information literacy. Scientific reports. Information retrieval. Correctness of the language. Master’s thesis.

Teaching Methods:

The presentation of the thesis will be arranged with the supervising professor. There will be no separate seminar.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Master’s thesis 100 %.

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

No

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

No

BH10A2000: 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: Ahti Jaatinen-Värri

Note:

In Master's programmes taught in English, the Master's thesis is always prepared in English.

Year:

M.Sc. (Tech.) 2

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

Associate professor, D.Sc. (Tech.) Ahti Jaatinen-Värri
Professors of the degree programme

Aims:

Upon completion of the course the students will be able to 1. formulate the research problem, 2. select the methods appropriate for the research problem, 3. find sources of information suitable for the research problem, and evaluate their validity and the quality and reliability of the data, 4. utilise and interpret the sources of information correctly, and 5. report the research in writing according to the scientific principles, considering the conventions used within the field of energy technology.

Contents:

The fundamentals of scientific research. Good scientific working methods when setting the research problem, selecting the research methods, and reporting the research, considering the conventions used within the field of energy technology. The utilisation of scientific information in problem solving. Information literacy. Scientific reports. Information retrieval. Correctness of the language. Master's thesis.

Teaching Methods:

The presentation of the thesis will be arranged with the supervising professor. There will be no separate seminar.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Master's thesis 100 %.

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

No

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

No

Obligatory

BH30A0201: Nuclear Reactor Design, 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: Juhani Hyvärinen, Anne Jordan

Note:

This course is available only to nationals of countries that have implemented adequate nuclear non-proliferation under the rules of the International Atomic Energy Agency (IAEA).

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Juhani Hyvärinen

Aims:

Upon completion of the course the students will be able to explain physical phenome underlying nuclear reactors, design a critical nuclear reactor using diffusion theory, and perform thermal design of the reactor core.

Contents:

Interaction of radiation with matter. Nuclear reactions and their cross sections. Reactor physics, diffusion theory, a simplified criticality calculation. The design principles for the reactor core, thermal dimensioning. An overview at the nuclear power programmes of different countries.

Teaching Methods:

1st period: Lectures 28 h, tutorials 14 h, country presentation 20 h, preparation for the interim exam 13 h and interim exam 3 h. 2nd period: Lectures 14 h, tutorials 14 h, assignment 39 h, preparation for the interim exam 8 h and interim exam 3 h. Total workload 156 h. Assignment and country presentation. Two written interim exams or one written final examination. Moodle is used in this course.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Number of mid-term examinations:

2

Assessment:

0-5. Written examination 70 %, assignment and country presentation 30 %. Possible to raise the grade by tutorials.

Course Materials:

Lecture notes. Lamarsh & Baratta: Introduction to Nuclear Engineering, 3rd edition (2014), where applicable.

Prerequisites:

BH30A0001 Introduction to Nuclear Energy or equivalent skills.

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

Yes, 10

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

Yes, 5

BH30A1701: Nuclear Reactor Physics Methods, 3 cp

Validity: 01.08.2016 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Juhani Hyvärinen, Ville Rintala

Year:

M.Sc. (Tech.) 2

Period:

2

Teaching Language:

English

Teacher(s) in Charge:

M.Sc. (Tech.) Ville Rintala, Professor, D. Sc. (Tech.) Juhani Hyvärinen

Aims:

Upon completion of the course the students will be able to derive the neutron transport equation from the basic physical phenomena, understand the concepts of neutron flux and current, and use simple numerical calculation methods for the neutron flux solution with diffusion approximation.

Contents:

The transport equation for neutrons. The diffusion of neutrons. Two-group diffusion theory. The effect of a source to the neutron flux. Simple numerical methods of reactor physics.

Teaching Methods:

Lectures 14 h, tutorials 14 h, computer exercises 4 h, assignment 46 h. Total workload 78 h. Moodle is used on this course.

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, assignment 100 %.

Course Materials:

Lecture notes: Leikkonen, Reaktorifysiikka (in Finnish). Reuss: Neutron Physics. Duderstadt & Hamilton: Nuclear Reactor Analysis, as applicable. Stacey: Nuclear Reactor Physics, as applicable.

Prerequisites:

BH30A0201 Nuclear Reactor Design and BH30A2104 Nuclear Reactor Dynamics.

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.

BH30A1801: Nuclear Reactor Physics Analyses, 3 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Juhani Hyvärinen, Ville Rintala

Year:

M.Sc. (Tech.) 2

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

M.Sc. (Tech.) Ville Rintala, Professor, D.Sc. (Tech.) Juhani Hyvärinen

Aims:

Upon completion of the course the students will be able to understand the deterministic reactor physics calculation system: transport codes for fuel bundle calculations and nodal methods for the whole core calculations, design the reactor loading compliant with applicable limitations (In-Core Fuel Management), and carry out simple Monte-Carlo calculations of reactor physics.

Contents:

Calculation methods of reactor physics for reactor fuel management purposes.

Teaching Methods:

Lectures 14 h, tutorials 14 h, computer calculations 4 h, preparation for the examination 43 h, written examination 3 h. Total workload 78 h. Moodle is used on this course.

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 %. Possible to raise the grade by tutorials.

Course Materials:

Reuss: Neutron Physics, Duderstadt & Hamilton: Nuclear Reactor Analysis, Stacey: Nuclear Reactor Physics, where applicable.

Prerequisites:

BH30A0201 Nuclear Reactor Design, BH30A1701 Nuclear Reactor Physics Methods, BH30A2104 Nuclear Reactor Dynamics.

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.

BH30A1901: Theoretical Nuclear Thermal Hydraulics, 3 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Otso-Pekka Kauppinen, Juhani Hyvärinen

Year:

M.Sc. (Tech.) 1

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Juhani Hyvärinen

Aims:

Upon completion of the course the students will be able to understand one-dimensional two-phase flow, heat transfer, boiling and condensation in pipelike geometry, master the basic continuity and constitutive equations for two-phase flow, utilise the basic equations in manual calculations, understand the continuity and constitutive equations used in computer models used in the thermal-hydraulic system codes (APROS/TRACE), and will be aware of elementary multidimensional two-phase flow modelling.

Contents:

The normal use, as well as the thermal hydraulic phenomena in disturbance and accident situations, of the reactor circuit and containment of a nuclear power plant. Continuity equations, closure laws, phenomenological models for phase interactions. Two-phase flow calculations using system codes. Two-phase flow modelling in computational fluid dynamics (CFD).

Teaching Methods:

Lectures 14 h, tutorials 14 h, computer calculations 4 h, preparation for the examination 43 h, written examination 3 h. Total workload 78 h. Moodle is used on this course.

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 %. Possible to raise the grade by tutorials.

Course Materials:

Ghiaasian: Two-Phase Flow, Boiling and Condensation, where applicable. Todreas, Kazimi: Nuclear Systems I & II, where applicable. Winterton: Thermal Design of Nuclear Reactors, where applicable. Wallis: One-dimensional Two-phase flow.

Prerequisites:

BH30A0201 Nuclear Reactor Design

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

Yes, 10

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

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

BH30A2001: Computational Nuclear Thermal Hydraulics, 3 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Otso-Pekka Kauppinen, Juhani Vihavainen

Year:

M.Sc. (Tech.) 1

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

D.Sc. (Tech.) Juhani Vihavainen

Aims:

Upon completion of the course the students will understand basic equations and special features in thermal hydraulic system code modelling, is able to describe the structure of computer codes, and can use system codes introduced in this course, APROS and TRACE, to prepare simple models and to run larger models.

Contents:

Thermal hydraulic phenomena of nuclear power plant during normal operation and incident and accident situations. Calculation and modelling of a two phase flow in computer codes. Modelling of essential processes in nuclear power plants with APROS and TRACE software. Two assignments. Optionally an excursion to the training simulator of Loviisa power plant.

Teaching Methods:

Lectures 14 h, tutorials 14 h, assignment 30 h, preparation for the examination 17 h, written examination 3 h. Total workload 78 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes (updated 3.5.17)

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

Lecture materials. APROS and TRACE code manuals, as applicable. Todreas, Kazimi: Nuclear Systems I & II, as applicable.

Prerequisites:

BH30A0201 Nuclear Reactor Design and BH30A1901 Theoretical Nuclear Thermal Hydraulics.

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.

BH30A2104: Nuclear Reactor Dynamics, 2 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: Heikki Suikkanen, Juhani Hyvärinen

Year:

M.Sc. (Tech.) 1

Period:

2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Juhani Hyvärinen

Aims:

Upon completion of the course the student will be able to explain nuclear reactor kinetics and related feedback mechanisms, principles of nuclear reactor control, and principles of efficient nuclear fuel utilisation.

Contents:

Nuclear reactor dynamic response and control. Neutron sources, approach to criticality, reactivity feedbacks in critical reactors, reactivity excursions, reactor power management, reactor poisons, fuel burnup management.

Teaching Methods:

Lectures 14 h, tutorials 14 h, preparation for the examination 21 h, written examination 3 h. Total workload 52 h. Moodle in use on this course.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Examination 100 %. Possible to raise the grade by tutorials.

Course Materials:

Reuss: Neutron Physics, Part I, as applicable.

Prerequisites:

BH30A0201 Nuclear Reactor Design

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.

BH30A2200: Experimental Nuclear Thermal Hydraulics, 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: Juhani Hyvärinen, Juhani Vihavainen, Otso-Pekka Kauppinen

Note:

Suitable also for doctoral studies

Year:

M.Sc. (Tech.) 1

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Juhani Hyvärinen

Aims:

Upon completion of the course the students will be able to describe basic measurement techniques for one- and two-phase flows, understand similitude and scaling of models, understand the interaction between experiments and code calculations, describe advanced flow structure mapping techniques (e.g. wire mesh sensing, particle image velocimetry).

Contents:

Temperature, pressure, pressure drop, liquid level and flow measurement techniques. Void fraction measurement. Similitude, scaling principles. Designing experiments for computer code validation. Advanced flow structure measurement techniques.

Teaching Methods:

Lectures 14 h, tutorials 14 h, laboratory demonstrations 16 h, computer calculations 4 h, quiz 8 h, writing reports 22 h. Total workload 78 h. Moodle is in use on this course.

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. Quiz 25%, reports of laboratory works 75%.

Course Materials:

Ghiaasian: Two-Phase Flow, Boiling and Condensation, as applicable.

Prerequisites:

BH40A0701 Measurements in Energy Technology or equivalent course experience.

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.

BH40A1800: Steam Turbines, 3 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: Teemu Turunen-Saaresti, Aki-Pekka Grönman, Juhani Hyvärinen

Year:

M.Sc. (Tech.) 2

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

Aki Grönman, D.Sc., Associate professor

Aims:

Upon completion of the course the students are able to: 1. Understand how the size of the turbine affects the design 2. Understand what requirements different power plants have for steam turbines and how turbines are connected to other parts of the plant 3. Understand the fundamentals of condensation in steam turbines 4. Understand the aerodynamic design principles of steam turbines.

Contents:

Influence of turbine size on the design and construction, turbines in different power plants, condensation in turbines, steam turbine aerodynamics, hood, and condenser.

Teaching Methods:

Lectures 14 hrs, exercises 14 hrs, Quizzes 8 hrs, Home assignments 14 h, Group assignment 28 h. Total workload 78 hrs.

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, Quizzes 20%, Assignments 80%.

Course Materials:

Lecture material in Moodle.

Prerequisites:

Recommended course BH40A0801 Turbomachinery or similar knowledge.

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

Yes, 25

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

Yes, 5

Choose enough courses to attain a min. of 60 ECTS in specialisation studies.

BH30A0701: Reliability Engineering, 4 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: Juhani Hyvärinen, Elina Hujala

Note:

Harjoitukset järjestetään kahdessa ryhmässä, suomeksi ja englanniksi.
The course will be lectured every other year, next during the academic year 2018-2019.
Suitable also for doctoral studies.

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

Yes, 2018-2019.

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

M.Sc. (Tech.), M.Sc. Elina Hujala, Professor, D.Sc. (Tech.) Juhani Hyvärinen

Aims:

Upon completion of the course the students will be able to calculate the reliability parameters for separate components and simple systems, formulate and solve fault and event trees for systems, and estimate the effect of human factors.

Contents:

Introduction to reliability engineering. Boolean algebra. The reliability parameters of components. The reliability engineering structure of systems; examples from different fields. Structural functions, reliability flow charts, fault trees, event trees, minimal cut sets. The reliability parameters of systems and their determination using different methods. Damage and effect analysis. The determination of parameters and trends from flaw observations. The improvement of the usage reliability of a system. Humans as a part of systems. Common mode failures, uncertainty analysis and importance measures. The reliability of structures.

Teaching Methods:

Lectures 21 h, tutorials 14 h. 1st period. Lectures 21 h, tutorials 14 h. 2nd period. Preparation for the examination 31 h and written examination 3 h. Total workload 104 h. Moodle is used in this course.

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 %. Possible to raise the grade by tutorials.

Course Materials:

Rausand M. & Hoyland A: System Reliability Theory, Models, Statisticals Methods and Applications.

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

Yes, 10

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

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

BH40A1501: Turbulence Models, 4 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Teemu Turunen-Saaresti

Note:

Suitable also for doctoral studies

Year:

M.Sc. (Tech.) 2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Associate professor (tenure track), D.Sc. (Tech.) Teemu Turunen-Saaresti

Aims:

Upon completion of the course the student will be able to recognize the characteristics of turbulence models and to estimate the suitability of different turbulence models for various fluid mechanical problems. In addition, the student will be able to interpret the physical basis and the theory of turbulence models.

Contents:

Navier-Stokes equations, RANS equations, Reynolds stress, eddy viscosity, algebraic, one equation and two equation models. Advanced models.

Teaching Methods:

3rd period: 12 h of lectures, 12 h of tutorials. 4th period: 12 h of lectures, 12 h of tutorials. Homework 20 h, Project work 35 h Total workload 103 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:

Homework 30%, project work 70%

Course Materials:

David C. Wilcox: Turbulence models for CFD.

Prerequisites:

BH70A0001 Numerical Methods in Heat Transfer

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.

BH50A1200: Energy Systems Engineering, 6 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, Juha Kaikko

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Esa Vakkilainen, Docent, D.Sc. (Tech) Juha Kaikko

Aims:

Upon completion of the course the student will be able to 1. describe different types of energy production processes, 2. utilize thermodynamics and heat and mass balances in the design of small scale energy systems, 3. use a “Systems Engineering” type approach to define the design values for energy production processes, 4. define small scale bioenergy production projects, 5. understand how plant requirements affect the planning and implementation phases of small energy systems, and 6. define economic constraints to small scale energy processes.

Contents:

History and fundamentals of thermodynamics and energy engineering. Modern problems of power plant engineering. Combined heat and power production, especially from biomass. Fundamentals of steam and gas turbines in energy production. Systems engineering. Planning and implementation of energy systems. Economic optimization of energy system projects.

Teaching Methods:

1st period: 12 h of lectures and case exercises. 2nd period: 12 h of lectures and case exercises. Written assignment, written examination. Independent study approximately: Written assignment 80 h. Preparation for the examination 16 h and the examination 3 h. Studying given material 33 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 70 %, written assignment 30 %.

Course Materials:

Lecture notes.

Prerequisites:

Understanding of basic thermodynamics.

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

Yes, 5

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

Yes, 5

BH50A1400: Steam Boilers, 6 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

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor D.Sc. (Tech.) Esa Vakkilainen

Aims:

Upon completion of the course the student will be able to 1. list typical biomass fuels and their properties, 2. understand the terminology used in maintenance management, 3. understand steam generation processes, especially from biomass, 4. describe the construction of steam boilers, 5. apply different types of steam boilers using different types of fuels, and 6. realize restrictions caused by corrosion, erosion and fouling.

Contents:

Characteristics of fuels, especially of biofuels. Combustion and gasification. Design of a steam boiler and its components. CCS. Energy balances. Solving steam boiler problems by mathematical modelling and algorithmization. Operation and maintenance of boilers: corrosion, fouling, emissions.

Teaching Methods:

1st period: 12 h of lectures and case exercises. 2nd period: 12 h of lectures and case exercises. Written assignment. Independent study approximately: Written assignment 48 h. Preparation for the examination 18 h and the examination 3 h. Studying given materials 63 h. Total workload 156 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

Yes

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

Lecture notes. Teir, Sebastian: Steam Boiler Technology, 2nd ed. 2006. Vakkilainen, Esa, Steam generation from Biomass, 2016.

Prerequisites:

Recommended: BH50A1200 Energy Systems Engineering.

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.

BL20A0401: Electricity Market, 5 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: Samuli Honkapuro

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. Samuli Honkapuro

Aims:

Upon completion of the course the student will be able to: 1. describe the characteristics of the different business sectors in the Nordic electricity market, 2. explain electricity price formation, 3. explain the operation principle of the power exchange, 4. identify and describe the products of the power exchange, 5. select the right risk management method for electricity trade, 6. describe the tasks of the different parties in an electric power system in maintaining technical and commercial power balance, including demand side management

Contents:

The restructuring of the electricity markets, power exchange, electricity trade, balance management.

Teaching Methods:

28 h of lectures, 1st period. Independent studies. Written examination.

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 distributed in class.

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.

BH30A0600: Radiation Protection, 3 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: Juhani Hyvärinen, Elina Hujala

Note:

In the course it is possible to take the qualification of radiation safety officer.

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

Yes, 2017-2018.

Year:

M.Sc. (Tech.) 1

Period:

2

Teaching Language:

Finnish

Teacher(s) in Charge:

M.Sc.(Tech), M.Sc. Elina Hujala, Professori, D.Sc.(Tech) Juhani Hyvärinen

Aims:

Upon completion of the course the students will be able to act as a radiation protection manager as mentioned in the radiation act for sealed sources and industrial radiography.

Contents:

Lectures on radiation protection and safety.

Teaching Methods:

Lectures 28 h, tutorials 14 h, laboratory work 4 h, assignment 21 h, preparation for the examination 8 h and written examination 3 h. Total workload 78 h. Moodle is used in this course.

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 %. Possible to raise the grade by tutorials.

Course Materials:

Lecture notes. Radiation and Nuclear Safety Authority, Finland: Säteily- and ydinturvallisuus, where applicable, as well as the valid legislation and the related radiation safety regulations.

Prerequisites:

BH30A0001 Introduction to Nuclear Energy.

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

No

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

Yes, 5

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

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

Validity: 01.08.2016 -

Form of study:
Type: Study module
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F

No course descriptions.

Obligatory Studies 25 ECTS cr

BK30A0803: Digital Advanced Manufacturing with Lasers, 5 cp

Validity: 01.08.2017 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Antti Salminen, Ilkka Poutiainen

Note:

Replaces the course BK30A0802 Laboratory Course of Laser Based Manufacturing.

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

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

Contents:

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

Teaching Methods:

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

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

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

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

No

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

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

BK30A0901: Additive Manufacturing - 3D Printing, 5 cp

Validity: 01.08.2015 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Antti Salminen, Heidi Piili

Year:

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

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

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

Contents:

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

Teaching Methods:

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

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

Yes

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

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

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

No

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

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

Related to:

to sustainability

BK30A1201: Laser Materials Processing, 5 cp

Validity: 01.08.2017 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Antti Salminen

Note:

Replaces the course BK30A1200 Laser Based Processes for Materials Processing.

Year:

M.Sc. (Tech.) 2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

After having passed the course module the student is able:
- to compare laser materials processing processes and knows different processes special features
- identify what are the theoretical basis affecting in different processes and how they affect the possible applications based on them
- to know how to select and optimize proper process and processing procedure for different materials
- understanding how processing parameters affect the quality of the process / part
- to define what kind of lasers and laser systems can be applied in various processes and

applications and how they could be applied
- is able to develop processes for different applications
- is able to work as expert to develop laser based processes for industrial applications

Contents:

- laser beam material interaction, transmission, reflection, absorption
- the features of different materials and laser beams affecting on phenomena
- the effect of laser based heating, melting, vaporization and ablation on material
- behavior of molten material and heat transfer mechanisms.
- formation of keyhole and phenomena connected
- knowledge on existing ways to process material with laser beam and the effect of laser beam material interaction on that
- knowledge on most common laser processes like laser welding, laser hybrid welding, cutting, marking, drilling, engraving, micro processing additive manufacturing and surface treatment and the lasers and laser systems used for carrying them out
- practical cases, applications will be combined to theory

Teaching Methods:

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

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

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

Course Materials:

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

Prerequisites:

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

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

Yes, 1-3

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

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

BK30A1300: Laser Based Manufacturing for Design, 5 cp

Validity: 01.08.2016 - 31.12.2017

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

After having passed the course module the student:
- knows how to select and develop proper process and processing procedure for processing of different materials
- is able to compare the special features of laser processing systems in production and specify systems accordingly
- realizes the impact and utilization of special features of the laser based processes on product design and is able to utilize these
- is able to utilize means of process monitoring to practice
- can work in tasks for developing production equipment, systems and production lines for laser based production

Contents:

This course is giving knowledge about industrial lasers and laser systems for materials processing in production and how laser processes special feature can be utilized in modern machine design. This includes various areas of technology involved:
- lasers, laser equipment, resonator types, accessories and processing systems and requirements of different ways to process material with laser beam.
- principles of utilization of potential of laser based processes in product design.
- special features of laser processing methods for product design.
- the principles of systems used for production.
- tools of beam forming, guiding and modification.
- knowledge on performance of most common laser processes like laser welding, cutting, marking, micro processing, additive manufacturing and surface treatment.
- optical components used with laser processing, safety and quality assurance.
- economical aspects and sustainability of laser materials processing.
- practical cases.

Teaching Methods:

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

Assessment:

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

Course Materials:

Course material in Moodle.

Prerequisites:

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

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

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

BK30A1400: Individual Project Work of Laser Technology, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Antti Salminen, Joonas Pekkarinen

Note:

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

Year:

M.Sc. (Tech.) 2

Period:

1-2 & 3-4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

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

Contents:

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

Teaching Methods:

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

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

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

Prerequisites:

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

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

No

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

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

KoDSaMate: Advanced Materials Engineering, 20 - 30 cp

Validity: 01.08.2016 -
Form of study:
Type: Study module
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F

No course descriptions.

Obligatory Studies 25 ECTS cr

BK90C1900: Introduction to Materials Engineering, 4 cp

Validity: 01.08.2016 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Timo Kärki

Year:

M.Sc. (Tech.) 1-2

Period:

2

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

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

Contents:

Basics of Materials Engineering and Product Design. Principles of materials selection and introduction to materials selection procedures. Choice of fabrication techniques including case studies related to different materials. Selecting polymers and composites as raw materials: structure, properties, processing characteristics and applications for the commercially important polymers including general classes of polymers: commodity,

engineering and specialty thermoplastics, thermosetting resins and rubbers. Introduction to specific metals, alloys and minerals: metallurgy, properties, applications and potentialities of metals, alloys and minerals in a wide variety of engineering environments. Wood materials. Introduction to engineering ceramics. Properties and manufacturing of carbon based materials. Recycled Materials as a raw material source.

Teaching Methods:

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

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, examination 70 %, seminar 30 %

Course Materials:

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

Prerequisites:

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

Yes, 10

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

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

Related to:

to sustainability

BK90C2000: Hybrid Materials, 3 cp

Validity: 01.08.2016 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Ossi Martikka

Year:

M.Sc. (Tech.) 1-2

Period:

2

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

Organic–inorganic hybrids and composites have been playing a major role in research and society in recent years. This course aims to give the participants an understanding of the

properties of the organic and inorganic components, preparation methods, characterisation techniques and also examples of functional hybrid materials. After having completed this course, the student should be able to: structure hybrid materials from separate raw material sources characterize hybrid materials with various testing methods can work in teams and solve problems related to hybrid materials

Contents:

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

Teaching Methods:

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

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

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

Prerequisites:

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

Yes, 10

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

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

Related to:

to sustainability

BK90C2100: Functional Properties of Nanomaterials, 3 cp

Validity: 01.08.2016 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Irina Turku

Year:

M.Sc. (Tech.) 1-2

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

D.Sc. (Tech.) Irina Turku

Aims:

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

Contents:

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

Teaching Methods:

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

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

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

Course Materials:

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

Prerequisites:

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

Yes

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

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

Related to:

to sustainability

BK90C2200: Sustainable Manufacturing of Advanced Materials, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Marko Hyvärinen, Timo Kärki, Katriina Mielonen

Year:

M.Sc. (Tech.) 1-2

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

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

Contents:

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

Teaching Methods:

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

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

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

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

Yes, 10

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

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

Related to:

to sustainability

BK90C2300: High Performance Products, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Timo Kärki

Year:

M.Sc. (Tech.) 1-2

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

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

Contents:

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

Teaching Methods:

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

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

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

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

Yes, 10

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

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

Related to:

to sustainability

BK90C2400: Project course in Material Engineering, 5 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Marko Hyvärinen

Year:

M.Sc. (Tech.) 1-2

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

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

Contents:

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

Teaching Methods:

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

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

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

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

No

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

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

Related to:

to sustainability

TuSOMBAN: Business Analytics, 24 - 30 cp

Validity: 01.08.2017 -
Form of study:
Type: Study module
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F

No course descriptions.

Obligatory courses

CS38A0010: Free analytics environment R, 6 cp

Validity: 01.01.2017 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F
Teachers: Jozsef Mezei

Year:

M.Sc. (Tech.) 1

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

Jozsef Mezei, D.Sc., Research Fellow

Aims:

The main goal of the course is to introduce the students to the statistical computing environment R as a tool for business analytics. In the course, students will explore the fundamentals of the R language fundamentals, with the main focus on understanding how to utilize it to perform data analysis. The course will make extensive use of real life datasets to illustrate the various features of R. After the completion of the course, the students: know how to work with data in R; understand the main tasks and applications of data science; create and customize visualization in R; know how to perform descriptive analytics in R; can create functions and implement basic methods; know how to perform predictive analytics using R.

Contents:

Core content: basics of data analysis with R; R as a data analysis environment for business analytics problems; performing descriptive and predictive analytics using R
Additional content: R as a programming environment for data science
Special content: role of visualization in business analytics

Teaching Methods:

Introduction to R completed with online platform studies (10 h). Programming with R for Data Science (50 h).
10 h of computer room tutorials. Reading and practicing additional material 20 h. Course project on performing data analysis 70 hours. Total workload for the student 160 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Finishing online courses (30%), course assignment (70%), grading 0-5.

Course Materials:

The book R Kabacoff, 2011: R in action
Additional material distributed in the course.

Prerequisites:

Basic knowledge of statistics. Only for master's program students.

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

Yes. 80, priority to MBAN students (Master's program in business analytics)

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

No

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

No

CS38A0045: Marketing analytics for Business students, 6 cp

Validity: 01.08.2017 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F
Teachers: Jozsef Mezei

Year:

M.Sc. (Tech.) 1

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Jozsef Mezei, D.Sc., Research Fellow

Aims:

The aim of the course is to offer extensive knowledge on the use of various analytical techniques in marketing. The students will be introduced to the process of decision support in marketing using analytics in various typical problems. Through several practical examples, the course aims to provide the tools that focus on data understanding and preprocessing, modelling choices and implementation until the interpretation, visualization and utilization of the analysis in various marketing-related problems. The course will provide hands-on lectures to using the various methodologies in the R statistical computing

environment, one of the most widely used analytics tools in modern organizations. After the course the students: have an understanding of the process of performing marketing analytics; know how to collect, understand and preprocess data to be used in marketing problems; know the most important applications and can identify the appropriate tool for a specific problem; are capable of performing marketing analytics using the R statistical environment; understand the role of big data in marketing.

Contents:

Core content: role of data in modern marketing, traditional methods (clustering, forecasting, market-basket analysis), machine learning-based methods in marketing (recommendation systems, advertising on the web)
Additional content: social network analysis, sentiment analysis
Special content: use of the introduced methods in R

Teaching Methods:

Lectures 20 h, computer room tutorials 10 hours, course assignments involving data analysis with R 75h. Written exam and preparation for the exam 55 h. Total workload for the student 160 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Course assignments (50% of the grade), written examination (50% of the grade), grading pass/fail. The exam will be the same as for the “Marketing analytics” course. The assignments of this course cover a part of the other course’s assignment.

Course Materials:

The course will largely be based on the free online book (http://www.mmds.org/)
Leskovec-Rajaraman-Ullman: Mining of Massive Datasets
Additional material will be distributed in the course.

Prerequisites:

The course will use the statistical software R, the LUT “Free analytics environment R” or equivalent background knowledge in R is required. Basic knowledge in statistics.

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

Yes. 50, priority to MBAN students (Masters program in business analytics)

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

No

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

No

A210A0601: Information Systems in Corporate Management and Decision-making, 6 cp

Validity: 01.08.2014 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F
Teachers: Mikael Collan

Year:

M.Sc. (Econ. & Bus. Adm.) 1

Period:

2

Teaching Language:

English

Teacher(s) in Charge:

professor, D.Sc. (Econ. & Bus. Adm.) Mikael Collan

Aims:

The aim of the course is to give extensive general knowledge about corporate information systems and how they are used in corporate decision-making, business control, and as a driver of business development. After the course the students: have an understanding of the corporate information systems stack and the most common types of corporate information systems and where they are used; are able to view a business as a system and its parts as parts of a system; know how information systems can collect, summarize, and analyze corporate information; understand what the practice of fact based management is based on and how it is connected to information systems; know the concept of intelligent systems, know selected methods and tools, understand the types of results that they can provide, and the importance of such results for, for example, making the business more effective through optimization; can identify situations where information systems can be used to develop business practices

Contents:

Core content: corporate information stack, business intelligence
Additional content : controlling in a modern corporation based on IS, intelligent systems in business process development, concepts of optimization, neural networks, simulation, and fuzzy logic
Special content: importance of visualizing knowledge

Teaching Methods:

Lectures 20 h, independent reading assignments (articles) and preparation for lectures 55h. Written exam and preparation for the exam 85 h. Total workload for the student 160 h. Possibly an excursion.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

Ei

Examination in Exam (Yes/No):

Ei

Assessment:

Grade 0-5, evaluation 0-100 points, written exam 100%.

Course Materials:

Lecture slides Assigned reading, collection of articles.

Prerequisites:

Only for the students accepted for the Master’s Degree Programmes.

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

Yes. 200, priority for MSF and MBAN students.

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

Yes, 30

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

Elective courses

A365A0320: Computational Data Analytics in Business Management, 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: Samuli Kortelainen

Year:

M.Sc. (Econ. & Bus. Adm.) 1

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Post.Doctoral Researcher, D.Sc. (Tech) Samuli Kortelainen

Aims:

The importance of different kinds of analytics solutions has significantly risen during the last years in management. Novel analytics solutions have been shown to have significant financial impact by either increasing the efficiency of the company or by even creating totally new business possibilities. This course aims to introduce students to the present capabilities and future possibilities of computational business analytics tools. After this course student will know:
- How to integrate analytics to strategic and operational management of a firm
- Possibilities and limitations of different kinds of computational analytics methods in business management

Contents:

1. Processes and routines necessary for data based business management a. Importance of organizational different kinds of organizational routines b. Different data sources in digitalization age i. Firm’s internal data sources ii. Internet & Big data analytics iii. Internet of things (IoT) 2. Different levels in management of firm’s business environment a. Individual (customers / firms) b. Network (Network between customers / firms) c. System level analysis (e.g. ecosystems) 3. Possibilities created by computational analysis methods in business management a. Possibilities created by network analysis b. Possibilities created by machine learning c. Possibilities in simulation modelling

Teaching Methods:

Virtual on-line lectures and individual work 16 h.
On site lectures 6 h.
1 x Seminar work 80 h.
Preparing for exam 38 h .
24 hour exam 16 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

Seminar work: 50 %, 24 hour exam: 50 %

Course Materials:

Eric Siegel (2013), Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die Course slides

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

Yes, 10

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

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

CS38A0050: Big data in business and industry, 6 cp

Validity: 01.08.2017 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Business and Management

Grading: Study modules 0-5,P/F

Teachers: Jozsef Mezei

Note:

Lectured first time in academic year 2018-19.

Year:

M.Sc. (Tech.) 2

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Jozsef Mezei, D.Sc., Research Fellow

Aims:

The course discusses the most important new tools for understanding the potential impact of big data analytics on decision making and business performance. Through analyzing typical business decision problems from the perspective of data requirements, the course discusses the role of big data analytics in modern organizations. After the completion of the course, the students: know the most important technological requirements of performing big data analytics; understand the role of big data in transforming modern organizations through data driven decision making; understand the impact of data volume, variety, and velocity; understand how to create value with big data; become familiar with the techniques and tools for capturing, processing, and interpreting big data; know the most important methods to reduce big data sets by extracting the most important information; are familiar with several real-world scenarios of big data use from different business sectors; understand the role of big data in creating business value; know how to apply the discussed concepts and tools to business projects.

Contents:

Core content: big data technology; data and dimension reduction; role of data driven decision making in modern organizations
Additional content: machine learning methods for big data analytics; network analysis
Special content: text analytics

Teaching Methods:

Lectures 20 h, computer room tutorials 10 hours, course assignments involving big data analysis with R 75 h. Written exam and preparation for the exam 55 h. Total workload for the student 160 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Course assignments (70% of the grade), written examination (30% of the grade), grading 0-5.

Course Materials:

The following two books cover several topics introduced in the course:
Vignesh Prajapati, 2013: Big Data Analytics with R and Hadoop
Thomas Davenport, 2015: Big Data at Work
Additional material will be distributed in the course.

Prerequisites:

The course will use the statistical software R, the LUT course
Free analytics environment R
or equivalent background knowledge in R is required. Basic knowledge in statistics.

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

No

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

No

TuSOEntr: Entrepreneurship, minor, 20 - 35 cp

Validity: 01.08.2016 -
Form of study:
Type: Study module
Unit: LUT School of Business and Management

No course descriptions.

Elective studies

CS30A1372: Creative Design and Problem Solving, 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: Andrzej Kraslawski

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Andrzej Kraslawski

Aims:

Learning outcomes: After fulfilling all requirements of the course, the students will be able to: 1. Understand the principles of creative problem solving 2. Know the basic methods of creative design 3. Work in team during the design process 4. Apply methods of creative design to products, processes, services and business methods

Contents:

The major subjects of the course are: Major Steps in Problem Solving Types of Problems Types of Design Concept of Creativity Survey of Intuitive and Structured Methods of Creativity Enhancement Types of Brainstorming Check lists Morphological analysis Synectics Case-based Reasoning Graphical Methods Evaluation of Ideas

Teaching Methods:

The course is organised as a combination of regular lectures and interactive problem-solving sessions and project works. The in-class problem-solving sessions will be based on the team work realised by the groups of 3-5 students. The 3-4 project works will be realised by the groups of 3-4 students during the out-of-class activities and it will be finished with the preparation of the project report. In-class teaching and problem-solving sessions 42 h, project works 88 h. Total workload 130 h.

Lectures, in class activity, period 1.
Project work, out-of - class activity, period 2.
Project work 88 hours

Suitability for doctoral studies (Yes/Leave empty):

Yes

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

Yes

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Final grade 0-5. Evaluation: Generated solutions of the in class problems 40 %, project reports 30 %, written exam 30%. Obligatory presence during 90% of in-class activities.

Course Materials:

Course slides.

Tony Proctor
Creative problem solving for managers
Routledge; 3rd edition, 2009

H. Scott Fogler and Steven E. LeBlanc
Strategies for Creative Problem Solving
Prentice Hall, 3rd edition , 2013

David Silverstein, Philip Samuel, Neil DeCarlo
The Innovator's Toolkit: 50+ Techniques for Predictable and Sustainable Organic Growth
Wiley, 2009

Alexander Osterwalder and Yves Pigneur
Business Model Generation
Osterwalder and Pigneur, 2010

Prerequisites:

Basic courses of management. Basic knowledge of engineering disciplines (e.g. process or mechanical engineering).

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

Yes, 90

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

Yes, 35

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

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

CS30A1691: Social Sustainability, 6 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Business and Management

Grading: Study modules 0-5,P/F

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

CS34A0302: Entrepreneurship Theory, 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: Timo Pihkala, Marita Rautiainen

Note:

Opintojakso sisältyy myös yrittäjyyden sivuaineeseen. Mikäli kurssilla on vain suomenkielisiä osallistujia, se luennoidaan suomeksi.

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Econ. & Bus. Adm.) Timo Pihkala
D.Sc. (Econ. & Bus. Adm.) Marita Rautiainen

Aims:

The student becomes familiar with the basic concepts of entrepreneurship, entrepreneurship theory and the latest theoretical directions within entrepreneurship research.

Contents:

Basic concepts of entrepreneurship, entrepreneurship theory, entrepreneurial person and the latest theoretical directions.

Teaching Methods:

Independent studies 148 h, lectures 8 h, total 156 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, Moodle-exams (50%) and written assignment (50%).

Course Materials:

Bridge, S., O´Neill, K. and Cromie, S. (2003): Understanding, Enterprise, Entrepreneurship and Small Business. (2nd ed.) Palgrave-MacMillan Shane, Scott: A general theory of entrepreneurship. The individual-opportunity nexus. Edward Elgar. Lecture materials

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

Yes, maximum 100. Priority is given to the student in Entrepreneurship masters program and students of entrepreneurship minor.

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

Yes

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

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

CS34A0401: Strategic Entrepreneurship in an Age of Uncertainty, 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: Ekaterina Albats, Justyna Dabrowska, Marko Torkkeli

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Marko Torkkeli

Aims:

Managing in a knowledge-based economy, Managing by Core Competences, Knowledge intensive firms, Uncertainty. Are they the latest buzz words or another passing managerial fad? Old wine in new bottles? Or perhaps, just perhaps, a fundamental means of survival and success for modern day corporations? Given the amount of effort that has been devoted to the topic by both academics and practitioners, it appears worth taking a deep and dispassionate look at the role of entrepreneurial thinking in sustained competitive advantage. The goal is to learn as you go and effectively convert assumptions to knowledge at a low cost. During the course students learn to develop and test a business idea following the discovery driven planning steps as well as using the uncertainty management tools of Attribute Mapping, Supply Chain Analysis, Differentiation, Quizzing and Market-Busters. The course does not teach business plan writing but rather focuses on opportunity recognition and feasibility assessment. Moreover, it adds the elements of lean and guerilla marketing as well as social entrepreneurship as possible avenues in dealing with entrepreneurial challenges.

Contents:

During the course students learn to develop and test a business idea following the feasibility analysis, discovery driven planning steps as well as using the uncertainty management tools of Attribute Mapping, Supply Chain Analysis, Differentiation, Quizzing and Market-Busters. The course does not teach business plan writing but rather focuses on opportunity recognition and feasibility assessment. Moreover, it adds the elements of lean and guerilla marketing as well as social entrepreneurship as possible avenues in dealing with entrepreneurial challenges.

Entrepreneurial thinking, uncertainty management, strategic entrepreneurship, discovery-driven planning.

Teaching Methods:

Lectures 20 h, Independent study 73 h, seminar work writing 63 h, 1. 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. Based on assignment and in-class work, participation in the lectures required.

Course Materials:

Lectures and additional reading provided in the class. Book: McGrath Rita and MacMillan Ian, (2000). The Entrepreneurial Mindset. Harvard Business School Press.; McGrath Rita and MacMillan Ian, (2005). MarketBusters: 40 strategic moves that drive exceptional business growth. Harvard Business Press.

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.

CS34A0551: Business Idea Development, 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: Timo Pihkala, Suvi Konsti-Laakso

Year:

M.Sc. (Tech.) 1

Period:

2

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Econ. & Bus. Adm.) Timo Pihkala

Aims:

Student can describe and explain key theoretical approaches associated to business idea development. The student learns to identify, develop and assess business opportunities and ideas. The student is familiar with and can apply different systematical tools and techniques related to business idea development.

Contents:

Core content: fuzzy-front end of entrepreneurial process, opportunity recognition, sources of business ideas, systemic generation of ideas; business idea related methods, structures and environments.
Supplementary content: innovation and creativity
Specific content: customer-oriented thinking

Teaching Methods:

Lectures 16 h. Learning diary and assignments 80 h. Written group assignment 60 h. In total 156 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Grades 0-5, Learning diary (60%) and group work and presentation (40)%.

Course Materials:

Study materials include article package and it will be announced later.

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

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

CS34A0721: Entrepreneurship, ownership and family firms, 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: Timo Pihkala, Marita Rautiainen

Note:

Replaces the course CS34A0720 Perheyrittäjyys.

Year:

M.Sc. (Tech.) 1

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Econ. & Bus. Adm.) Timo Pihkala
D.Sc. (Econ. & Bus. Adm.) Marita Rautiainen

Aims:

The course introduces the student with the phenomenon of entrepreneurship, ownership, and family firm. After the course the student knows the conceptual special characteristics and the central theories of

these phenomena. In addition, the student learns about ways to manage the transitional processes such as family business succession.

Contents:

Course explores the unique challenges and opportunities involved in managing a family firm. The course will address a wide variety of topics, including: the strengths and weaknesses of a family firm; the dynamics of family interactions; family business culture; conflict resolution in a family firm; transferring ownership of a family firm; planning for a family firm's growth and continuity; effective leadership and communication; and planning for succession.

Teaching Methods:

Lectures 20 h 3rd period. Prior reading and assignments 106 h. Preparation for lectures 30 h. In total 156 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

Yes

Examination in Exam (Yes/No):

No

Assessment:

Individual exercise 50 %, group exercise 30 % moodle exam 20 %

Course Materials:

1. Ernesto J. Poza (2010). Family Business, South-Western, Cengage Learning.
2. Materials indicated during lectures
3. Cases and articles delivered during the course.

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

Yes, maximum 80. Priority is given to the student in Entrepreneurship masters program and students of entrepreneurship minor.

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

Yes

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

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

A330A5101SS: Creativity and Entrepreneurship in New Product Development from Silicon Valley's Perspectives, 3 cp

Validity: 01.06.2015 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Business and Management

Grading: Study modules 0-5,P/F

Teachers: Olli Kuivalainen

Note:

The course topics are related to sustainable development.

Year:

M.Sc. 1-2

LUT Summer School time:

17.-21.7.2017

Teaching Language:

English

Teacher(s) in Charge:

Professor D.Sc. (Econ.) Olli Kuivalainen, LUT

Aims:

Learning outcomes:

- To understand important elements of marketing strategy that is related to product management.
- To develop an in-depth understanding of new product/service development and management.
- To understand and utilise a process-oriented framework for making new product/service development decisions.
- To enhance business communication skills through preparation and presentation of new concepts for products and services via prototyping as well as its marketing plan.

Contents:

This course is designed to explore two critical business topics related to product management strategy in marketing:

- the design and development of new ideas for product/service innovations
- the management of new and existing products and services for sustainable business.

First, topics in new product development include idea generation and screening, design, planning, and prototyping, and new product roll-out, as well as the development of marketing strategies and implementation plans for new products and services.

Second, management of new and existing products involves in integration of new products into the product line, management of the marketing mix, quality of service, and customer development strategies. Throughout this project-based course, the importance of creativity, innovation and entrepreneurship will be emphasised as the sources of initiating and managing new products and innovation.

Teaching Methods:

- Lectures and in-class learning activities and assignments 28 hours
- Preparation for lectures and assignment 30 hours
- Preparation for the exam, and exam 22 hours

Total workload 80 hours.

Assessment:

Final grade 0-5. Evaluation 0-100 points:

- Final exam 30 points
- Group project 20 points
- In-class projects 5 points
- Group case studies 10 points
- Individual projects 20 points
- Class-participation 15 points

Course Materials:

- Main Textbook: C. Merle Crawford and C. Anthony Di Benedetto, New Products Management, 10th ed. Irwin McGraw-Hill.
- The additional reading materials from academic and business press articles (i.e., case, magazine, newspaper, and journal articles) will be distributed through the class time prior to the class discussion.

Prerequisites:

Previous studies in marketing recommended.

YmDSaResp: Environmental Responsibility, 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 22 ECTS cr

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: Mika Luoranen, Jouni Havukainen, 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

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 Luoranen, Mika Horttanainen

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

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: Mirja Mikkilä, Anna Kuokkanen, Lassi Linnanen

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

SaDSaIE: Industrial Embedded Systems, 21 cp

Validity: 01.08.2009 -
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)

BL40A1811: Introduction to Embedded Systems, 6 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: Tero Ahonen, Jero Ahola

Year:

B.Sc. (Tech.) 3

Period:

3-4

Teaching Language:

Finnish and English

Teacher(s) in Charge:

Researcher Tero Ahonen, professor Jero Ahola

Aims:

The course is an introduction to embedded systems. Upon completion of the course the student will be able to: 1. identify different microprocessor types and peripheral components in embedded systems, 2. describe the operation principles of an embedded system and its peripheral components, 3. program and test applications to an embedded system by using C language.

Contents:

Architecture of a microprocessor, instruction set and operation, microcontrollers, memories, peripherals, embedded system design, programming and development of applications, embedded system design examples.

Teaching Methods:

Lectures 14 h, exercises, 14 h, 3rd period. Lectures 14 h, exercises, 14 h, 4th period, Assignments. Examination. 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 % and assignments 50 %. Satisfactorily completed assignments are required for passing the course.

Course Materials:

Vahid/Givargis: Embedded System Design - A Unified Hardware/Software Introduction.
Lecture material.

Prerequisites:

Basics of programming in C.

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

Yes

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

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

BL40A1202: Digital Control Design, 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: Pasi Peltoniemi, Rafal Jastrzebski, Olli Pyrhönen

Note:

Replaces the course BL40A1201, 5 ECTS

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

Finnish and English.

Teacher(s) in Charge:

Professor Olli Pyrhönen, D.Sc. (Tech) Rafal Jasrzebski, D.Sc. (Tech.) Pasi Peltoniemi

Aims:

Upon completion of the course students are able to design and implement a digital control system for industrial application independently. The necessary skills are dynamic plant modeling, system design, control synthesis, system simulation and digital controller implementation in an industrial control platform.

Contents:

The teaching approach on this course is practical control design and implementation for different applications. The application relate to electrical drives, power electronics, motion control, power generation and process control. The application topics may change yearly. The following topics are included; plant modelling, different state-space and transfer functions algorithms for SISO and MIMO systems, digital controller synthesis, system simulation, controller programming and testing. The digital control design methodology will be applied for above mentioned applications.

Teaching Methods:

14 h of lectures, 12 h of exercises (computer class room), laboratory working 2 h, 1st period, 14 h of lectures, laboratory working 12 h, assignments and seminars 2. period.

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:

Examination 60%, assignments 40%.

Course Materials:

Lecture script and handout, more detailed material in the text books: Franklin G.F., Powell J.D., Workman M.L., Digital Control of Dynamic Systems, Addison-Wesley, 1998, Kuo B., Digital Control Systems, 2nd ed., Oxford University Press, 1992, Åström K.J., Wittenmark B., Computer Controlled Systems, 3rd ed., Prentice Hall, 1997, 557 p.

Prerequisites:

BL40A0200 Säätötekniikan perusteet A or BL40A0300 - Säätötekniikan perusteet B
BL40A0501 - Digitaalisäädön perusteet

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

Yes, 10.

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

No

BL40A1101: Embedded System Programming, 5 cp

Validity: 01.08.2017 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Tuomo Lindh, Teemu Sillanpää, Jouni Vuojolainen

Note:

Replaces the course BL40A1100 Embedded System Programming, 4 ECTS

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Associate professor, D.Sc. (Tech.) Tuomo Lindh

Aims:

Upon completion of the course the student will be able to: 1. apply C language and its structures to embedded system programming, 2. form complex data types such as structures, unions and buffers and use these in order to maintain information of different entities (e.g. processing units), 3. control the registers of a micro controller using C-language, 4. use different PUs of a micro controller, 5. Take into use a real time operation system.

Contents:

Design tools, C-language in embedded system programming, utilization of a micro controller environment (registers, timers, buses, A/D conversion etc.). Typical data structures, typical program structures in real-time applications.

Teaching Methods:

14 h of lectures, 14 h of tutorials, 1st period. 14 h of lectures, 14 h of tutorials, 2nd period. Assignment. Written examination. Total workload 104 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, assignment 1 50 %, examination 50 %. Satisfactorily completed assignment required.

Course Materials:

Wolf, W.: Computers as components: principles of embedded computing system design. Lecture notes.

Prerequisites:

Basics of C language.

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.

BL40A2810: Automation, 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: Tuomo Lindh, Jan-Henri Montonen

Note:

Replaces the course BL40A2800 Electrical Motion Control Systems, 6 ECTS

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Associate professor, D.Sc. (Tech.) Tuomo Lindh

Aims:

Upon completion of the course the student will be able to: 1. apply automation and digital control theory to practical implementations, 2. use the analog and digital communication

techniques applied to automation, 3. apply fieldbuses, 4. formulate a dynamic system model of motor drives 5. Simulate servo motor driven mechatronic systems, 6. construct controllers and models of dynamic systems using IEC61131-3 and C programming languages 7. construct dynamic system models based on tests and measurements, 8. select a proper controller structure, 9. work in a group solving automation and control problems.

Contents:

IEC61131-3 programming languages, Automation hardware and software. Fieldbuses. Basics of servo drive dynamics, System identification and parameter estimation. dynamic system models based on tests and measurements. Co-simulation of electric drives and mechanics, digital motion control.

Teaching Methods:

Lectures 14 h, exercises 14 h, 1st period. Lectures 14 h, exercises 14 h, project work, laboratory exercises, 2nd period. Independent study: project work 35 h, laboratory exercises 12 h, preparation for examination 40 h, examination 3 h. Examination. 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 100 %. Satisfactorily completed project work required.

Prerequisites:

BL40A0110 Measurement and Automation Technology, Introduction.

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

Yes

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

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

MaDSaM300: Intelligent Computing, 20 cp

Validity: 01.08.2014 -
Form of study:
Type: Study module
Unit: LUT School of Engineering Science
Grading: Study modules 0-5,P/F

No course descriptions.

Obligatory Studies, 12 ECTS cr

BM40A0701: Pattern Recognition, 6 cp

Validity: 01.01.2016 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Engineering Science
Grading: Study modules 0-5,P/F

Teachers: Lasse Lensu

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.) Lasse Lensu

Aims:

A student can understand a pattern recognition problem, select an appropriate pattern recognition method, and implement a working solution. A student can analyse the performance and quality of a pattern recognition system.

Contents:

Introduction to pattern recognition, supervised and unsupervised learning. Statistical pattern recognition and Bayesian inference. Linear and non-linear classifiers such as artificial neural networks, support vector machines and decision trees. Reinforcement learning and unsupervised pattern recognition.

Teaching Methods:

Lectures 14 h, lecture preparation 7 h, exercises 14 h, exercise preparation 21 h, 1. period. Lectures 14 h, lecture preparation 7 h, exercises 14 h, exercise preparation 21 h, practical assignment 40 h, 2. period. Self-study 4 h. Total amount 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):

Yes (for remote participants)

Number of mid-term examinations:

0

Assessment:

0 - 5. Homework and exercises 30%, exercise quizzes (or exam) 40%, practical assignment 30%.

Course Materials:

Duda, R.O., Hart, P.E., Stork, D.G.: Pattern Classification, Wiley, 2001. Theodoridis, S., Koutroumbas, K.: Pattern Recognition, Academic Press, 2003.

Prerequisites:

Recommended BM20A4301 Johdatus tekniseen laskentaan, BM20A5001 Principles of Technical Computing, BM20A5800 Funktiot, lineaarialgebra ja vektorit, BM20A5810 Differentiaalilaskenta ja sovellukset, BM20A5820 Integraalilaskenta ja sovellukset, BM20A5840 Usean muuttujan funktiot ja sarjat, CT60A0210 Käytännön ohjelmointi, BM20A1401 Tilastomatematiikka I, BM20A1501 Numeeriset menetelmät I, BM20A1601 Matriisilaskenta, BM40A0501 Johdatus laskennalliseen älykkyyteen, or equivalent knowledge.

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

Yes, 5

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

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

BM40A1201: Digital Imaging and Image Preprocessing, 6 cp

Validity: 01.01.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Tuure Tuuva, Lasse Lensu, Erik Vartiainen

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.) Lasse Lensu, Professor, Ph.D. Tuure Tuuva, Associate Professor, Ph.D. Erik Vartiainen

Aims:

A student understands how radiation interacts with matter, how images can be captured and the image formation modelled, and how preprocessed images can be used for measurement purposes. The student is able to characterise imaging and the factors affecting it, and affect image quality in practice.

Contents:

Electromagnetic radiation and light interaction with matter, sources of radiation and illumination techniques, imaging sensors and manufacturing technologies, spectroscopy, imaging optics, sensor and image acquisition modelling and characterisation, digital image encoding and characteristics, image preprocessing techniques, and image-based measurement.

Teaching Methods:

Lectures 14 h, lecture preparation 7 h, exercises 14 h, exercise preparation 14 h, 1. period.
Lectures 14 h, lecture preparation 7 h, exercises 14 h, exercise preparation 14 h, practical assignment 40 h, 2. period.
Self-study 18 h. Total amount 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):

Yes (for remote participants)

Number of mid-term examinations:

0

Assessment:

0 - 5. Homework and exercises 25 %; exercise quizzes (or exam) 50 %; practical assignment 25 %.

Course Materials:

Kasap, S.O.: Optoelectronics and Photonics, Prentice-Hall, 2000. Gonzales, R.C., Woods, R.E.: Digital image processing, Prentice-Hall, 2002. Jain, A.K.: Fundamentals of digital image processing, Prentice-Hall, 1989.

Prerequisites:

Recommended BM20A4301 Johdatus tekniseen laskentaan, BM20A5001 Principles of Technical Computing, BM40A0501 Johdatus laskennalliseen älykkyyteen, or equivalent knowledge.

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

Yes, 5.

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

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

Select enough courses to attain 20 ECTS cr together with obligatgory courses.

BM10A1100: Advanced Methods in Mathematics, Computing and Physics, 3 - 6 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Erkki Lähderanta, Arto Kaarna, Jouni Sampo

Year:

M.Sc. (Tech.) 2

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, D.Sc. (Tech.) Arto Kaarna, Professor, Ph.D. Erkki Lähderanta, University Lecturer, D. Sc. (Tech.) Jouni Sampo.

Aims:

The student will obtain theoretical and operational skills in some specific area of applied mathematics, computational methods, and technical physics. He understands the methods and knows how to apply the methods to modeling problems in mathematics, science and engineering.

Contents:

The course consists of literature review, working on exercises and completing practical projects. Materials will be chosen and agreed individually according to the focus of the study

module, students' interests and research in the laboratories. The course with the same title can be included in the study programme twice when two distinct areas are covered. The course is related to sustainability.

Teaching Methods:

Self-study of learning materials, exercises, project assignment and reporting, seminar presentation, total 80-160 h, 1st-4th period.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Number of mid-term examinations:

0

Assessment:

Pass/Fail, report and seminar presentation 100 %.

Prerequisites:

Recommended: BSc. in Computational Engineering and Technical Physics, first year studies in the specialization of the M.Sc. studies.

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

No

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

No

BM20A3001: Statistical Analysis in Modelling, 5 cp

Validity: 01.08.2008 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Engineering Science
Grading: Study modules 0-5,P/F
Teachers: Heikki Haario

Note:

Suitable also for doctoral studies

Year:

M.Sc. (Tech.) 1

Period:

3

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Heikki Haario

Aims:

Introduction to modern computational methods of estimating reliability of modeling and simulation results. After the course, the student is able to estimate parameters of nonlinear models by measured data and to create posterior distributions for parameters and model predictions by MCMC (Markov chain Monte Carlo) methods.

Contents:

Introduction to the methods of estimating reliability of modelling. Errors and uncertainty in experimental data. Uncertainty in model parameters and prediction results. Bayesian approach for parameter estimation and inverse problems, various Monte Carlo (MCMC) methods for nonlinear models.

Teaching Methods:

Lectures 21 h, exercises 14 h, homework 35 h, practical assignment 38 h, preparation for examination and the examination 22 h, 2nd period. Total 130 h.

Assessment:

0-5, examination 100 %.

Course Materials:

To be given at the lectures.

Prerequisites:

First year university calculus, BM20A1401 Tilastomatematiikka I. Recommended BM20A2000 Simulation.

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

Yes, max. 15

BM20A3102: Fuzzy Sets and Fuzzy Logic, 6 cp

Validity: 01.08.2017 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Pasi Luukka

Note:

Suitable also for doctoral studies.
Replaces the course BM20A3101 Fuzzy Sets and Fuzzy Logic 6 ECTS cr.

Year:

M.Sc. (Tech.) 1-2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, D.Sc. (Tech.) Pasi Luukka

Aims:

In the end of the course student is expected to be able to understand basic mathematical concepts related to fuzzy set theory and fuzzy logic. Able to model uncertain concepts, create fuzzy models, apply and solve them.

Contents:

The course consists of concept of fuzziness, some algebras of fuzzy sets, fuzzy quantities, logical aspects of fuzzy sets, operations of fuzzy sets, fuzzy relations, fuzzy compositional calculus, aggregation operators, possibility theory, fuzzy inference systems, information uncertainty.

Teaching Methods:

Lectures 28 h, exercises 14 h, 1st period. Lectures 28 h, exercises 14 h, 2nd period. Preparation for exam and the exam 70 h. Altogether 154 h from which independent work 70 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:

Nguyen, H.T., Walker, E.A.: A First Course in Fuzzy Logic, 2nd Ed., Chapman & Hall/CRC, 2000.
Klir, G., Yuan, B.:Fuzzy Sets and Fuzzy Logic. Theory and Applications, Prentice Hall, 1995.
Fullér, R.: Introduction to Neuro-Fuzzy Systems, Physica-Verlag, 2000.

Prerequisites:

Bachelor level basic math courses.

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

No

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

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

BM20A3401: Design of Experiments, 4 cp

Validity: 01.08.2008 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Engineering Science
Grading: Study modules 0-5,P/F
Teachers: Heikki Haario

Note:

Suitable also for doctoral studies.

Year:

M.Sc. (Tech.) 1-2

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Heikki Haario

Aims:

After the course, the student is expected to master the basic skills for effective experimentation, together with regression analysis of data:
- understanding of the importance of designed experiments
- ability to apply the basic experimental plans, and regression techniques to analyse the results
- skills to optimize an engineering process using design of experiments and data analysis.

Contents:

Importance of experimental design, minimization of prediction uncertainty of regression models. Basic factorial designs: 2N, Central Composite designs for regression analysis. The Taguchi principles. Experimental optimisation of engineering processes.

Teaching Methods:

Lectures 21 h, exercises 14 h, homework 21 h, experimental work in laboratory 26 h, preparation for examination and the examination 22 h, 4th period. Total 104 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Assessment:

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

Course Materials:

Box, G., Hunter, S., Hunter, W. G.: Statistics for Experimenters, Wiley 2005, 2nd Edition.

Prerequisites:

First year university calculus, BM20A1401 Tilastomatematiikka I/basic statistics. Basic (Matlab) skills for technical computing with PC.

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

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

Related to:

to sustainability

BM20A3602: Fuzzy Data Analysis, 6 cp

Validity: 01.08.2010 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Engineering Science
Grading: Study modules 0-5,P/F
Teachers: Pasi Luukka

Year:

M.Sc. (Tech.) 1-2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, D.Sc. (Tech.) Pasi Luukka

Aims:

In the end of the course student is expected to be able to
- understand theoretical aspects of data analysis

- understand the principles of multi-criteria decision making and is capable of applying them
- model and analyze uncertainty in different problem settings
- apply fuzzy principal component analysis, fuzzy clustering and classification methods to data analysis problems

Contents:

Fuzzy sets and relations. Uncertainty measures. Qualitative and quantitative analysis of fuzzy data. Introduction to possibility theory and generalized measure theory. Principles of individual multiperson, multicriteria making, fuzzy interpolation, fuzzy principal component analysis, fuzzy clustering and classification, fuzzy regression analysis. Evaluation of methods.

Teaching Methods:

Lectures 28 h, exercises 28 h 3rd period. Project work, 75 h, 4th period. Preparation for exam and the exam 30 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, examination 100 %. Project work.

Course Materials:

Bandemer, H., Näther, W.: Fuzzy Data Analysis, Kluwer Academic Publ., 1992.

Prerequisites:

Recommended BM20A3101 Fuzzy Sets and Fuzzy Logic

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

No

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

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

BM20A5001: Principles of Technical Computing, 4 cp

Validity: 01.08.2014 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Matylda Jablonska-Sabuka

Year:

B.Sc. (Tech.) 2. M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

D.Sc. (Tech.) Matylda Jablonska-Sabuka

Aims:

Students get a good understanding of Matlab syntax and programming, gain fluency in principles of technical computing and are able to apply the skills to basic mathematical and engineering problems (the skills are applicable in big part to Octave and R programming, too).

Contents:

Working with various data structures (multidimensional arrays, cell arrays, etc.) and variable types (numeric, logical, textual, etc.), Matlab symbolic functionality, conditional statements (if-else, switch-case), loops (for and while), using built-in functions, handling external data, 2-D and 3-D plotting, writing user-defined functions, optimization of code speed, style and efficiency.

Teaching Methods:

Lectures 12 h, computer class exercises 24 h, independent study 30 h, preparation for exam 34 h, 1st period. Total 100 h. EXAM-tentti.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

0-5, examination 100 %.

Course Materials:

Lecture material available in Moodle, based partly on textbook: Gilat, A.: An Introduction to Matlab with Applications.

Prerequisites:

Basic University Calculus required. Recommended first year university calculus necessarily including matrix calculus.

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

Yes, 1-10

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

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

Related to:

to sustainability

BM20A6200: Inverse Problems and Normed Spaces, 6 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Jouni Sampo

Note:

Replace courses BM20A2500 Linear Algebra and Normed spaces and BM20A5600 Inverse Problems and Sparse Transforms.

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

University lecturer, D.Sc. (Tech.) Jouni Sampo

Aims:

The student knows the concepts of function spaces and related basic terminology of functional analysis. Student understand and is able to use classical methods for solving linear inverse problems like of estimation of signal from incomplete or corrupted measurements.

Contents:

Vector spaces, bases and linear operators. Linear subspaces and projections. Norms, metric and convergence. Various function spaces, Banach spaces, Lp-spaces, Hilbert spaces. Formulation of inverse problems with additive noise. Ill-posedness and inverse crimes. Truncated singular value decomposition for inverse problems, Tikhonov and total variation regularization.

Teaching Methods:

Lectures 21 h, exercises 14 h, independent study and homework 40 h, 1st period. Lectures 21 h, exercises 14 h, independent study and homework 43 h, 2nd period. Exam 3h. Total 156 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Exam 100%

Course Materials:

Study material will be informed/distributed through the Moodle portal.

Prerequisites:

Basic Matlab skills are required (in 2nd period). BM20A1601 Matrix calculus is recommended.

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

Yes, max 5

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

Yes, max. 15

BM40A0801: Machine Vision and Digital Image Analysis, 6 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Heikki Kälviäinen

Note:

The course will be lectured every other year, next during the academic year 2017-2018.
Replaces the course BM40A0800 Machine Vision and Digital Image Analysis.
Suitable also for doctoral studies.

Year:

M.Sc. (Tech.) 1-2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

After the course a student is expected to be able to explain the fundamental steps of image processing and analysis; to introduce and compare machine vision applications; to plan a solution to a given object recognition problem; and to implement practical solutions for machine vision problems using Matlab or other suitable programming language.

Contents:

Digital image processing: digital image, image transforms, image enhancement, image compression. Image analysis: segmentation, representation and description, recognition and interpretation. Hardware, software and applications.

Teaching Methods:

Lectures and seminars 21 h, exercises 14 h, 3rd period. Lectures and seminars 21 h, exercises 14 h, 4th period. Preparation for the seminar presentations and acting as an opponent, homework, and practical assignment 47 h, self-studying of taught matters and relevant literature and preparation for the exam 36 h, 3rd and 4th period. Exam 3 h. Total amount 156 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

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

Yes

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, exam 50 %, exercises 50 %. Seminar presentation. Acting as an opponent. Practical assignment.

Course Materials:

References and material published on the course web page.

Prerequisites:

Recommended BM40A0701 Pattern Recognition, BM40A0901 Computer Vision, BM40A1201 Digital Imaging and Image Preprocessing, BM40A0501 Johdatus laskennalliseen älykkyyteen

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

Yes, 5

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

No

BM40A0901: Computer Vision, 6 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Arto Kaarna

Note:

The course will be lectured every other year, next during the academic year 2018-2019.
Replaces the course BM40A0900 Computer Vision.
Suitable also for doctoral studies.

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

Yes, 2018-2019.

Year:

M.Sc. (Tech.) 1-2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, D.Sc. (Tech.) Arto Kaarna

Aims:

A student understands the theoretical basis of geometric and dynamic computer vision, and can apply the knowledge to solve practical problems in computer vision. A student can explain basic approaches and applications for image processing and feature extraction for single images and video sequences. Stereo vision. Detecting, localizing, and recognizing objects and tracking objects in multiple images. Student is able to implement simple application in computer vision.

Contents:

Computer vision in 3D scenes. Imaging models and calibration. Coordinate frames and geometrical primitives. Single and multi-view geometry. Pose estimation. Dynamic vision and tracking. Structure from motion. Vision in robotics.

Teaching Methods:

Lectures 21 h, exercises 12 h, exercise preparation 12 h, 3rd period. Lectures 18 h, exercises 14 h, exercise preparation 14 h, seminar 2h; practical assignment and seminar preparation 46h, 4th period. Independent study 14 h, exam 3 h. Total 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, exam 60 %, exercises 40 %. Practical assignment.

Course Materials:

Emanuele Trucco, Alessandro Verri: Introductory Techniques for 3-D Computer Vision. Prentice Hall, 1998. E. R. Davies: Computer and Machine Vision, Fourth Edition: Theory, Algorithms, Practicalities, 4th Edition. Elsevier, 2012. Richard Hartley, Andrew Zisserman: Multiple View Geometry in Computer Vision, 2nd Edition. Cambridge University Press, 2004. David A. Forsyth, Jean Ponce: Computer Vision: A Modern Approach, 2nd Edition. Prentice Hall, 2011.

Prerequisites:

BM20A5800 Funktiot, lineaarialgebra ja vektorit, BM20A5810 Differentiaalilaskenta ja sovellukset, BM20A5820 Integraalilaskenta ja sovellukset, BM20A5830 Differentiaaliyhtälöiden peruskurssi, BM20A5840 Usean muuttujan funktiot ja sarjat, CT60A0200 Ohjelmoinnin perusteet. Recommended BM20A1401 Tilastomatematiikka I, BM20A1501 Numeeriset menetelmät I, BM20A1601 Matriisilaskenta, BM40A0500 Johdatus laskennalliseen älykkyyteen or equivalent knowledge.

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

Yes, 5.

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

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

BM40A1400: GPGPU Computing, 6 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Arto Kaarna, Aleksandr Bibov

Year:

M.Sc. (Tech.) 1-2

Period:

Intensive week 43, periods 2 and 3.

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, D.Sc. (Tech.) Arto Kaarna

Aims:

The student is able to reorganize computational tasks in order to best fit a given GPU architecture. The student is able to implement inter-operability between a GPU-boosted code and MATLAB/Python environment.

Teaching Methods:

Lectures 20 h, exercises 15 h, pre-assignment 24 h, intensive week 43. Seminar 4 h, post-assignment and seminar preparation, 93 h, periods 2 and 3. Totally 156 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, report and seminar presentation on the assignment.

Course Materials:

Popular GPU-accelerated Applications, http://www.nvidia.com/docs/IO/123576/nv-applications-catalog-lowres.pdf. Other materials will be announced at lectures.

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.

KaSOIbm: International Business and Management, 21 - 35 cp

Validity: 01.08.2016 -
Form of study:
Type: Study module
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F

No course descriptions.

Obligatory courses 21 cr

A370A0401: Case-Course of Business, 6 cp

Validity: 01.08.2012 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F
Teachers: Jukka-Pekka Bergman

Year:

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

Period:

1-2, 3-4

Teaching Language:

English

Teacher(s) in Charge:

Post-Doctoral Researcher, D.Sc. (Tech.) Jukka-Pekka Bergman

Aims:

After completing the course, the student is familiar with basics of case-writing. S/he is able to describe business practices, organizational processes and structures, and explain their development using the frameworks s/he has previously learned. In addition, the student is able to construct a well-written

description of a case-company and its development as well as development targets using different empirical materials and methods.

Contents:

Strategy analysis. Case study methodology. Case-writing.

Teaching Methods:

Lectures 4 h, selection of case-company and collection of data 40 h, reading of the literature needed in the description 40 h, case-writing in English (international groups) or Finnish 76 h and possible final seminar (4 hours). Total workload for student 160 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Grade 0-5, evaluation 0–100 p. Literary group assignment 100%.

Course Materials:

Lecture slides.

Prerequisites:

B. Sc. (Econ. & Bus. Adm.) 2 studies

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

Yes

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

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

A380A0000: Cross-Cultural Issues in International Business, 6 cp

Validity: 01.08.2011 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F
Teachers: Igor Laine

Year:

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

Period:

3

LUT Winter School time:

Yes

Teaching Language:

English

Teacher(s) in Charge:

Post-doctoral researcher, D.Sc. (Econ. and Bus. Adm.) Igor Laine

Aims:

The goal of the course is to give an understanding of how the cultural environment affects management in international business, and advance students' global mindset by giving conceptual tools to increase their intercultural competence. After completing the course the students can:
- define and categorize culture
- explain cultural orientations towards time, space and context
- analyze and compare national cultures according to Hofstede's, Trompenaars' and GLOBE cultural dimensions
- understand the relationship between culture,
organizations and management - evaluate the effects of the cultural environment on international marketing strategies
- examine the sources of cultural conflicts in international organizations
- identify the role of cultural factors in managing and leading international teams
- apply studied theories and ideas to business situation
General aim of the course is to improve following personal skill sand abilities of the students:
- recognizing cultural differences
- interacting effectively with people from other cultures
- working in groups and international teams

Contents:

Concept and levels of culture, dimensions of culture in business (Hall, Hofstede, Trompenaars and GLOBE), the effect of culture on leadership and management in international business The limits of globalization from the cultural perspective, cross-cultural issues in virtual teams, standardization and adaptation in international marketing Country cases of cultural differences (term paper reports)

Teaching Methods:

15 hours of lectures, case study workshop (2 hours) and term paper presentation seminar (4 hours). Preparation for lectures 12 h. Writing of term paper, preparation for case study and term paper presentations, 63 h. Written exam and preparation for exam 65 h. Total workload for student 160 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Grade 0-5, evaluation 0-100 points, written exam 60 %, term paper 30 %, case assignment 10 %, all assignments must be passed to obtain final grade.

Course Materials:

1. Browaeys & Price: Understanding Cross-Cultural Management (3rd edn), Pearson, 2015
2. Assigned readings
3. Lecture slides
4. Additional material distributed in class and via Moodle

Prerequisites:

Basic course in management or marketing

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.

A380A0200: Promotion and Sales Management, 6 cp

Validity: 01.08.2011 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Business and Management

Grading: Study modules 0-5,P/F

Teachers: Tommi Rissanen, Anssi Tarkiainen

Year:

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

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, D.Sc. (Econ. & Bus. Adm.) Anssi Tarkiainen
Doctoral Student, M.Sc. (Econ. & Bus. Adm.) Tommi Rissanen

Aims:

After completing the course the student will understand how marketing communication (MC) and sales management (SM) are planned and implemented in an organization. This course will pay special emphasis on understanding the linkages between marketing communication and sales, and the challenges in their integrated management. The learning outcomes of the course are the following:
- to understand the role of MC and SM in marketing strategy
- to assess the usability of different forms of communication with regard to buyer behavior
- to be able to design, implement and manage marketing communication as part of the marketing process
- to be able to design, implement and manage sales as part of the marketing process
- to assess the challenges of integrating MC and sales management strategies
- to evaluate the effectiveness of MC and sales
- to recognize the ethical issues of promotion and sales management

Contents:

The role of marketing communication (MC) and sales management in marketing strategy. The role of buyer behavior and its effects on the nature of communication (mass vs interactive/personal). MC strategy process, message and media strategy. Media planning and characteristics of different media. Sales process and selling typologies. Responsibilities and tasks of sales management. Online marketing and selling. Strategic planning process of MC and sales; challenges of integrating MC and sales management strategies. Evaluation and ethics of promotion and sales management. The advertiser-agency relationship. The services in marketing communications campaign planning.

Teaching Methods:

Lectures 21 h 4. period. Exercises 15 h 4. period. Preparation for exercises 58 h (including written work) and preparation for the exam 66 h. Written exam. Total workload for student 160 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

Final grade 0-5, evaluation 0-100 points. Exercises 40 points, written exam 60 points.

Course Materials:

Selected articles and material that is provided during the course.

Prerequisites:

A130A0250 Kansainvälisen markkinoinnin perusteet

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.

A380A6050: Introduction to International Business and Planning, 3 cp

Validity: 01.08.2011 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Business and Management

Grading: Study modules 0-5,P/F

Teachers: Sami Saarenketo, Toivo Äijö

Year:

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

Period:

1 (intensive)

Teaching Language:

English

Teacher(s) in Charge:

D.Sc. (Econ.) Toivo S. Äijö, Top Trainers Group
Professor, D.Sc. (Econ. & Bus. Adm.) Sami Saarenketo

Aims:

To familiarize the students with the fundamentals of international business in general and strategic planning for international business in particular. To provide the students with the analytical skills required for critical evaluation of actual international business strategies.

Contents:

- The changes in the international Business environment and their effect on strategic planning.
- Theories of international trade and business.
- The institutions of international trade and business.
- The essence of competitive strategy.
- Levels of strategic planning.
- International expansion strategy.
- Supporting research.
- International marketing strategy: entry modes, targeting, product, service, pricing, promotion, sales and CRM.
- International functional strategies.
- Case studies.

Teaching Methods:

Intensive course during 1. period. 25 hours of lectures, interactive analyses, case exercises and assignments, carried out by the student, 55 hours, total course 80 h. Written examination.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Graded 0-5 on the basis of case studies and class participation 20 % and written examination 80 %, evaluation 0 – 100 points.
50 % class attendance and participation required.

Course Materials:

The study material will be distributed at the beginning of the lectures.

Prerequisites:

Basic course in marketing

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

Yes

Notes:

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

Elective 3 cr (if 24 cr minor needed)

A380A6000: Cross-Cultural Encounters, 3 cp

Validity: 01.08.2011 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F
Teachers: Tanja Karppinen, Aino Harinen, Minna Koponen

Year:

B.Sc. (Tech.) 1-3, B.Sc. (Econ. & Bus. Adm.) 1-3

Period:

3

LUT Summer School time:

8.1.-2.3.2018.

Teaching Language:

English

Teacher(s) in Charge:

Tanja Karppinen

Aims:

By the end of the course, students will know why it is important to understand and appreciate cultural differences both in business and private life. Students will be able to explain the basic concepts of intercultural communication by the main course themes: cultures and communication, verbal and nonverbal communication, national stereotypes, intercultural sensitivity, cross-cultural interaction, culture shock, adaptation, expatriate assignments. Students will be able to describe themselves as an intercultural communicator, recognize symptoms of culture shock in their own life and know how to make intercultural adaptation process easier.

Contents:

The purpose of the course is to develop students' abilities to understand and appreciate cultural differences both in business and private life.
- cultures and communication
- verbal and nonverbal communication
- national stereotypes

- intercultural sensitivity
- cross-cultural interaction
- culture shock
- adaptation
- intercultural effectiveness
- expatriate assignments

Teaching Methods:

24 hours of lectures and case exercises in English and 56 hours of out-class work. Total course 80 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Graded 0-5 on the basis of activity, assignments given during the lectures and a portfolio composed of them. Case exercises 80 %, active participation and attendance 20 %. Evaluation 0 – 100 points.

Course Materials:

Reading material for the course provided by the lecturer.

Prerequisites:

Active participation and 80 % attendance.

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

Yes, 30

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

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

KoDSaManu: Modern Manufacturing, 20 - 30 cp

Validity: 01.08.2016 -
Form of study:
Type: Study module
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F

No course descriptions.

Obligatory Studies 25 ECTS cr

BK50A4000: Production Processes in Modern Job Shops, 5 cp

Validity: 01.08.2016 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Juho Ratava, Mika Lohtander

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

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

Contents:

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

Teaching Methods:

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

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

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

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

No

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

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

BK50A4100: Manufacturing Systems and Scheduling, 5 cp

Validity: 01.08.2016 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Mika Lohtander, Esko Niemi

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

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

Contents:

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

Teaching Methods:

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

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

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

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

No

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

No

BK50A4200: Product Flow in Job Shops, 5 cp

Validity: 01.08.2016 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Mika Lohtander

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

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

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

After having passed the course, the student will:
1. know the the factory management duty and responsibility
2. is able to take responsibility for the daily operations of a production plant
3. know the stakeholders role for production

Contents:

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

Teaching Methods:

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

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

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

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

No

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

No

BK50A4300: Managing Job Shops, 5 cp

Validity: 01.08.2016 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Mika Lohtander

Note:

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

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

Yes, 2017-2018.

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

After having passed the course, the student will:
1. know the factory management duty and responsibility
2. is able to take responsibility for the daily operations of a production plant
3. know the stakeholders role for production

Contents:

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

Teaching Methods:

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

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

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

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

No

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

No

BK50A4401: Fabrication Laboratory, 5 - 10 cp

Validity: 01.08.2017 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F
Teachers: Mika Lohtander

Note:

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

Year:

M.Sc. (Tech.) 1-2

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

After having passed the course, the student will:
1. get touch some important research topics in field of manufacturing
2. be familiar how to transfer research result to practice
3. is capable to create or build simple and practical solutions.

Contents:

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

Teaching Methods:

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

Suitability for doctoral studies (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

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

Course Materials:

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

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

No

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

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

SaDSaEDM2: Power Electronics and Electrical Drives, 20 cp

Validity: 01.08.2009 -

Form of study:

Type: Study module

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

No course descriptions.

Choose a min. of 20 ECTS cr)

BL30A0600: Power Electronics, 6 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: Lasse Laurila

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Associate professor, D.Sc. (Tech.) Lasse Laurila

Aims:

Upon completion of the course the student will be able to: 1. demonstrate good general knowledge of the different basic main circuits in modern power electronics, 2. describe the features and functions of different rectifiers, switch-mode converters and inverters, 3. calculate and simulate typical design tasks of the aforementioned circuits, 4. describe the joint operation of static converters and loads as well as the network interferences caused by converters and alternatives to reduce these interferences.

Contents:

Operation of the main circuits of different power converters: rectifiers (single and three-phase), DC-DC switch mode converters and power supplies (buck, boost, buck-boost, flyback, forward), inverters (single and three-phase), resonance converters (ZVS, ZCS). Characteristics and operation. Pulse width modulation (PWM). Harmonic components. Simulation of power electronic circuits.

Teaching Methods:

Combined lectures and tutorials, 28 h, 1st period. Combined lectures and tutorials, 28 h, 2nd period. Independent study 100 h. Total workload 156 h. Written examination. Available in distance learning program.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, examination 100 %. Possible extra assignments to gather extra points to the exam.

Course Materials:

Mohan, Undeland, Robbins: Power Electronics, converters, applications, and design, where applicable.

Prerequisites:

BL30A0000 Electric Circuits. Integration and derivation (esp. sine and cosine functions). FFT. Laplace transforms.

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.

BL30A1001: Electrical Drives, 8 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: Juha Pyrhönen

Note:

The first part (2nd period) will be studied in collaboration with BL30A1020 Electrical Drives, Compact. Common lectures, seminars, exercises and homework.

Year:

M.Sc. (Tech.) 1

Period:

2-3

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

Upon completion of the course the student will be able to: 1. understand the role of electrical drives, 2. understand different torque producing principles in different machines, 3. model and simulate a DC motor drive, 4. describe the principles of scalar, vector and direct torque control of rotating field machines, 5. define and understand the functioning of the most important power electronic converters, 6. discuss the principles of PWM in general, space vector modulation and DTC, 7. model the behaviour of permanent magnet synchronous machine by using vector equivalent circuits and vector diagrams, 8. understand synchronous machine control in details, 9. understand synchronous reluctance machine control in details, 10. understand the role of induction machine and its control in details, 11. know the switched reluctance machine control principles, 12. discuss the adverse effects of PWM systems on motor behaviour and the wave nature of the motor cable. Mastering the course material well gives the student comprehensive understanding of the basics of electrical drives and wide possibilities to work in the field. This is the course for drives professionals.

Contents:

Theory of electric motor drives, operation and vector equivalent circuits. Synchronous machine drives, asynchronous machine drives, synchronous reluctance machine drives, permanent magnet synchronous machine drives, switched reluctance motor drives. Torque production in different machines. Power electronic converters suitable for motor and generator drives. Scalar control, vector control, direct flux linkage control and direct torque control (DTC). Motor cable wave nature, bearing currents. Applying the principles for practical electrical machine types

Teaching Methods:

Lectures or seminars 24 h, tutorials 24 h, 2nd period. Lectures or seminars 24 h, tutorials 24 h, 3rd period. Independent study 112 h. Total workload 208 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, written examination 100 %.
Or “Accepted” via good enough independent homework, active seminar attendance and presentation.

Course Materials:

The course is based on the book: Pyrhönen, Hrabovcova, Semken: “Electrical Machine Drives Control: An Introduction”, published by John Wiley et Sons 2016

Prerequisites:

The students are recommended to have completed the courses BL30A0000 Electric Circuits, BL10A0100 Basics of Electric Engineering, BL30A0200 Laboratory Course in Electrical Engineering, BL30A0500 Introduction to Electrical Drives and BL30A0800 Electromagnetic Components and to have attended the course BL30A0400 Design of an Electrical Machine.

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.

BL40A2810: Automation, 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: Tuomo Lindh, Jan-Henri Montonen

Note:

Replaces the course BL40A2800 Electrical Motion Control Systems, 6 ECTS

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Associate professor, D.Sc. (Tech.) Tuomo Lindh

Aims:

Upon completion of the course the student will be able to: 1. apply automation and digital control theory to practical implementations, 2. use the analog and digital communication techniques applied to automation, 3. apply fieldbuses, 4. formulate a dynamic system model of motor drives 5. Simulate servo motor driven mechatronic systems, 6. construct controllers and models of dynamic systems using IEC61131-3 and C programming languages 7. construct dynamic system models based on tests and measurements, 8. select a proper controller structure, 9. work in a group solving automation and control problems.

Contents:

IEC61131-3 programming languages, Automation hardware and software. Fieldbuses. Basics of servo drive dynamics, System identification and parameter estimation. dynamic system models based on tests and measurements. Co-simulation of electric drives and mechanics, digital motion control.

Teaching Methods:

Lectures 14 h, exercises 14 h, 1st period. Lectures 14 h, exercises 14 h, project work, laboratory exercises, 2nd period. Independent study: project work 35 h, laboratory exercises 12 h, preparation for examination 40 h, examination 3 h. Examination. 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 100 %. Satisfactorily completed project work required.

Prerequisites:

BL40A0110 Measurement and Automation Technology, Introduction.

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

Yes

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

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

Alternative to each other, choose one.

BL30A0901: Power Electronic Components, 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: Lasse Laurila

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Associate professor, D.Sc. (Tech.) Lasse Laurila

Aims:

After the course the student can: 1. describe the properties and suitable applications of different power electronic devices. 2. calculate the losses of the device and design suitable cooling and protection.

Contents:

Basic semiconductor physics, semiconductor devices, passive components, energy storages. pn-junction, operation principles of power electronic switches, switching phenomena, losses, applications. Manufacturing methods, gate and base drive circuits, cooling methods, protection methods. Simulation of power electronic components.

Teaching Methods:

Lectures and tutorials, 28 h, 3. period. Lectures and tutorials, 28 h, 4. period. Written examination. Independent work 74 h. Total 130 h. Available in distance learning program.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, examination 100 %. Possible extra assignments to gather extra points to the exam.

Course Materials:

Mohan, Undeland, Robbins: Power Electronics, converters, applications, and design, where applicable.

Prerequisites:

BL30A0000 Electric Circuits. Integration and derivation.

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.

BL50A0600: Electromagnetic Compatibility in Power Electronics, 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: Pertti Silventoinen, Juhamatti Korhonen

Note:

Suitable also for doctoral studies.

Year:

M.Sc. 2

Period:

2

Teaching Language:

English

Teacher(s) in Charge:

D.Sc. (Tech.) Juhamatti Korhonen

Aims:

Upon completion of the course the student will be able to: 1. describe the coupling mechanisms of electromagnetic interferences in power electronics, 2. name the most significant sources of electromagnetic emissions in power electronic systems, 3. recognize and be aware of cable reflection in electrical drives, 4. list the suitable filter types for common mode filtering, du/dt filtering and harmonics filtering.

Contents:

Power electronics as an interference source, network harmonics, reflection phenomena of cables, conductive RF interference, interference radiation of power electronics, filtering techniques of conductive interferences.

Teaching Methods:

14 h of lectures, 1st period. Written examination. Independent work 40 h. Total workload 55 h.

Suitability for doctoral studies (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, written examination 100 %.

Course Materials:

To be announced in class.

Prerequisites:

Recommended: Basic knowledge of electromagnetism and electromagnetic fields.

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

Yes, 20

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

SaDREE: Renewable Energy and Energy Efficiency, 20 cp

Validity: 01.08.2015 -

Form of study:

Type: Study module

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

No course descriptions.

Choose a min. of 20 ECTS cr. BL10A8400 is a LUT Summer School course.

BL10A8400SS: Solar Economy and Smart Grids, 3 cp

Validity: 01.06.2014 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Satu Viljainen, Jarmo Partanen, Christian Breyer, Olli Pyrhönen

Note:

The course topics are related to sustainable development.
The course is also suitable for doctoral studies.

Year:

M.Sc. (Tech.) 1–2

LUT Summer School time:

7. – 11.8.2017

Teaching Language:

English

Teacher(s) in Charge:

Professor Christian Breyer, LUT

Aims:

After having passed this course the student is able to:

- understand the basic processes of solar economy and Smart Grids
- recognize the key properties of global climate challenges, solar economy, electricity market models, wind and solar power technologies, energy storage technologies and smart grid concept
- recognize the most important aspects, chances and challenges of transformation from existing energy systems to sustainable energy systems

Contents:

During the course the student will become familiar with the properties and application areas of:

- Climate change
- Solar economy
- Wind power technology
- Solar power technology
- Energy Storages
- New electricity market
- Demand response
- Smart Grid concept

The course is also suitable for doctoral studies.

Teaching Methods:

- Introductory lectures and exercises 24 hours
- Team work and a limited project work 20 hours
- Presentations of the results of the team work/ project work 8 hours
- Independent work is needed 26 hours

Total workload 78 hours

Suitability for doctoral studies (Yes/Leave empty):

Yes

Assessment:

Final grade 0 – 5. Evaluation:
- project work 70 %
- presentation 30 %

Course Materials:

Lecture notes

Prerequisites:

Previous studies either in electrical engineering, environmental engineering or energy engineering are recommended.

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: Michael Child, Christian Breyer

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.

BL40A2301: Energy Efficiency, 6 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: Jero Ahola, Antti Kosonen, Lasse Laurila, Tero Kaipia, Tero Ahonen

Year:

M.Sc. (Tech.) 1

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc (Tech.) Jero Ahola, Postdoctoral Researcher, D.Sc (Tech.) Tero Ahonen, different lecturers

Aims:

Upon completion of the course the student will be able to: 1. determine actions for the energy efficiency of the energy conversion process, 2. estimate the overall energy efficiency of the energy conversion system, 3. identify applications of electric energy usage and apply methods that can be used to improve the energy efficiency.

Contents:

The course provides the student with an introduction to the significance and development potential of energy efficiency in energy production, transmission, distribution and end use. The focus is on electric energy and systems approach. The lecture topics are the efficiency of energy production processes, the efficiency of electricity transmission and distribution and the efficiency of energy end use. The course is arranged as a series of lectures delivered by experts. The lecture topics may vary from year to year.

Teaching Methods:

Lectures 12 h, individual home works, demo lectures, 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 %, accepted individual home works.

Course Materials:

Lecture material, material announced by lecturers.

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

Yes

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

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

BL40A2401: Electrical Engineering in Wind and Solar Systems, 6 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: Olli Pyrhönen

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Olli Pyrhönen

Aims:

Upon completion of the course the student can: 1. describe and identify electrotechnical components and system layouts in wind and solar power plants, 2. dimension the electrotechnical components in wind /solar power plants, 3. describe and analyse the control systems of wind/solar power plants, 4. describe and analyse the grid connection requirements of wind/solar power plants, 5. analyse and simulate the interaction between the grid and wind/solar power plant in different abnormal situations.

Contents:

Drive train technologies in wind power systems; Permanent magnet synchronous generator drive train, double-fed induction generator drive train, electric conversion in PV solar power, system topologies and power electronics solutions in small and utility scale PV solar plants. Control of a wind power plant, control of a solar power plant, technical requirements in grid connection, voltage and reactive power control in wind/solar power plants, electrical protection of wind/solar power plants. Grid codes, other international regulations and standards in wind and solar power systems. Introduction to grid connection modelling software.

Teaching Methods:

Lectures 28 h, demolectures or visiting lectures 14 h, assignments, 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 50 %, assignment 50 %

Course Materials:

Material handed out in class.

Prerequisites:

Previous knowledge of electrical engineering required. Basics of electrical machines and/or transmission of electricity recommended.

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

Yes, 10.

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

No

TiDSOSE: Software Engineering, 24 - 30 cp

Validity: 01.08.2017 -
Form of study:
Type: Study module
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F

No course descriptions.

Obligatory courses 18 ECTS cr

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

CT60A5102: Models and Methods of Software Engineering, 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: Ahmed Seffah

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D., PEng. HDR. Ahmed Seffah

Aims:

The course covers the main software engineering methods including object-oriented, agile, formal as well as traditional approaches. At the end of this course, the students should be able to:
1. Understand and select the appropriate method or methods for the software development project at hand and for the various types of software systems such as critical-safety systems, interactive consumer services, enterprise applications, hardware software, etc.
2. Master the importance of modeling techniques in software engineering and the diverse types of models. Students should be able to explain the concepts of models, meta-models, platforms dependent and independent models, model-to-model transformations, automated code generation from models.
3. Manage, plan, analyze and contribute to the requirements, design, implementation and maintenance of large software products.
4. Understand how human, social and technical factors may have both positive and negative influences on software engineering methods and practices.
5. Identify the challenges facing the software engineering research community as well as the avenues for further investigations.

Contents:

Software Engineering Body of Knowledge (SWEBOK). Principles and foundations of software engineering. Agile software development. Formal methods. Prototyping techniques. Object-oriented design and analysis. Data-centric methods. Model-driven architecture (MDA). Modeling techniques. Importance of modeling in software development projects. Software engineering tools. Information, structure and behavioral modeling. Systematic literature review and large case studies on specific models and

methods, their uses and abuses such as UML, use cases, user task-based prototypes, Z, B, G-Express and BPMN (Business Process Modeling Notation).

Teaching Methods:

Lectures/seminars on selected topics 24h. Presentations 8h, weekly self-study 48 h (mandatory readings), scientific literature review and case studies 56 h, period 1-2. Research papers 20 h. Total 156 h. The course is designed to be a forum for a scientific discussion and presentations by the professor, students and guests' researchers. Except an introductory lecture, the professor will be mainly acting as a senior project manager and a researcher advising students regarding literature review, reliable information sources on software engineering as well as how to select, review and present a case study on software engineering methods. The students will have to work in a team of 2-3; each team will make 2 presentations in class; each student will have to contribute to the writing of a research paper that can be submitted to a conference or a workshop. Altogether, the presentations provide a systematic framework for selecting the appropriate methods for complex software systems development projects.

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. Research assignment (60%); research paper (40%) and presentation in class (10%).

Course Materials:

There is no book that covers all the topics addressed in the course. A selection of readings from top journals will be used as basic readings; students are requested to make their own literature review. IEEEE Transactions on Software Engineering IEEE Software ACM Transactions on Software Engineering Methodologies Journal of Software and Systems (JSS) Communication of the ACM The students are encouraged to walkthrough, one of the two following books as a basic introductory reading: R.S Pressman. Software Engineering: A Practitioner's Approach, 7/e, McGraw Hill, 2010 J. Sommerville. Software Engineering. 9/e, Addison Wesley, 2011

Prerequisites:

CT60A4001 Ohjelmistotuotanto

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

Yes, 48

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

Yes

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

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

CT60A5300: Software Projects, Processes and Entrepreneurship, 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: Uolevi Nikula, Timo Pihkala, Marita Rautiainen, Suvi Konsti-Laakso

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, D.Sc. (Tech.) Uolevi Nikula
Professor, D.Sc. (Econ. & Bus. Adm.) Timo Pihkala

Aims:

The course establishes a solid and common ground on software project management practices, software processes and entrepreneurship in Finland. After the course the students know how to plan and run a software project, how process models are related to software projects, and how an entrepreneur thinks, acts, and establishes a business in Finland.

Contents:

Software project planning, cost estimation and control. Software processes, history, maturity, and state of the practice. Software development teams and organizations. Entrepreneurship theory, entrepreneurial characteristics and skills, business start-up in Finland, LUT supporting entrepreneurship, business idea development, business opportunities, and co-creation processes.

Teaching Methods:

Lectures 14 h, exercises 14 h, assignments & self-study 14 h, team assignments 36 h, 1. period. Lectures 14 h, exercises 14 h, assignments & self-study 14 h, team assignments 36 h, 2. period. 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. Weekly and team assignments 100 %, no exam.

Course Materials:

Robillard, Kruchten, and d'Astous: Software Engineering Process with the UPEDU, Addison-Wesley, 2002. Other materials announced in the lectures.

Prerequisites:

Software Engineering CT60A4001 or equivalent.

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

Yes, 20

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.

Elective courses, min 6 ECTS cr

CT10A7040: Code Camp, 1 - 5 cp

Validity: 01.08.2016 - 31.07.2017

Form of study: Basic studies

Type: Course

Unit: LUT School of Business and Management

Grading: Study modules 0-5,P/F

Note:

The course is an intense course lasting from one day to a week, and the actual timing of each course is announced separately. This course can be included in one degree two times provided that the course contents are different.

Year:

M.Sc. (Tech.) 1-2

Period:

1-4, intense course

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

The students learn to work with given software development technologies in teams and innovate solutions to given software development challenges in a given time box.

Contents:

Students are presented a problem in the beginning of each code camp and they develop solutions to the problem in the given time box with the given technologies. After presenting the problem for the code camp, the students innovate possible solutions and start learning the given technologies. The main part of the code camp is spend developing the solution and learning to use the technologies in a collaborative manner before the working solutions are presented in the closing seminar. A code camp lasts typically a weekend or one week, and the technologies used in each code camp are decided case by case. The detailed implementation of each code camp is accepted by the head of the degree program, and the detailed course instructions are published in the course page in Moodle.

Teaching Methods:

Team software project completed in the code camp format based on the detailed course instructions. Each code camp is announced at least a month before the event, and it can last from one weekend to one week. Total workload is specified in the detailed course instructions and can be 26-130 h.

Assessment:

Passed/failed. Teamwork during the code camp and presentation after it.

Course Materials:

Study materials are specified in the detailed course instructions and during the lectures.

Prerequisites:

The prerequisites are specified in the detailed course instructions

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.

CT30A8910: Software as a Service: Architectures and Engineering, 6 cp

Validity: 01.08.2017 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Business and Management

Grading: Study modules 0-5,P/F

Teachers: Ahmed Seffah

Note:

Can't be included into a same degree as CT60A7201 Architecture in Systems and Software Development or CT30A8904 Software Systems as a Service: Technology and Engineering.

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D., PEng, HDR. Ahmed Seffah

Aims:

1. Understanding of the service orientation and software as a service as a fundamental shift to producing, deploying and using software applications, as well as a domain for academic research.
2. Architecting and implementing service systems and Web services that merge business and technical requirements to support the needs of an organization.
3. Mastering the technology used in modeling, designing, and composing services to create an effective SOA-based application.
4. Understanding the new business challenges and opportunities of software as a service versus shrink-wrapped software systems.
5. Applying the SOA (software-oriented architecture) and software architecture principles and techniques to the design, programming, testing, and public cloud deployment of Web services-based systems.

Contents:

Service-orientation fundamentals and principles. Software as a Service (SaaS). Internet of services. Platform and software engineering tools as a Service (PaaS). Infrastructure as a service (IaaS). Service-Oriented Architecture (SOA) principles and technologies. Service design patterns. Security, sustainability, and privacy. SOA governance. Service lifecycle management. Web services programming. Successful and failures stories from industry. Large team-oriented project on service systems for sustainability innovation. Sustainability is addressed at two different levels in this course: 1. Similar to security and other software quality attributes, sustainability is defined as a key quality attribute of a service system 2. Students are encouraged to consider projects related to the re-engineering of existing software systems and/or the development of innovative services to support sustainability development including the management of natural resources consumption as well as the ways software services can make citizens more aware about their impacts on the environment.

Teaching Methods:

Lectures 16 h, lecture preparation (weekly mandatory readings) 24 h, in class exercises 16h, practical analysis, design and development team-oriented project 64 h, Self-study and research poster 24 h. Final exam preparation 10h. Final exam (open book) 2 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. Final Exam 30%, Practical design, Practical analysis, design and programming project 40%, research posters 30%.

Course Materials:

Mandatory readings:
1. Selected chapters from Thomas Erl. Service-Oriented Architecture: Concepts, Technology and Design. Prentice Hall, 2005 (http://www.servicetechbooks.com)
2. Selected research and white papers by the professor; announced during the lecture.
Additional readings: Thomas ERL Website (http://www.serviceorientation.com) Fox, Armando and Patterson, David. Engineering Software as a Service: An Agile Approach Using Cloud Computing. First edition.

Prerequisites:

Advanced programming course.

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

Yes

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

Yes, 10

CT60A5400: Fundamentals of Game Development, 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: Antti Knutas

Year:

M.Sc. (Tech). 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Junior Researcher, M.Sc. (Tech.) Antti Knutas

Aims:

The objective for this course is for students to learn how to use the selected game development tools, and enable them to independently design and develop a small game program for the supported platforms or work as a part of a team developing a larger game product. After the course, the student is able to do independent work and is capable of acquiring further knowledge concerning the taught game development tool.

Contents:

Basics of the game development tool, introduction to game engines and their functions. Basics of working with 3D objects, introduction to game development-related programming. Basics of sound engineering. Gamification and Serious games.

Teaching Methods:

Assisted self-study, two project works. 14h of lectures, no exercises.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

Yes

Examination in Exam (Yes/No):

No

Assessment:

Grade 0-5, Teacher grading (50%) and Peer grading (50%)

Course Materials:

Materials provided by lecturer.

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

Yes, 10-15

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

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

CT60A7322: Software Business Development, 3 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: Marianne Kinnula

Year:

M.Sc. (Tech.) 1-2

Period:

Intensive week 20

Teaching Language:

English

Teacher(s) in Charge:

Docent, Ph.D. Marianne Kinnula

Aims:

After completing the course, the student has knowledge of how to 1. develop a software business idea over the whole life cycle of the business, 2. conduct market and business analyses, 3. identify sources for financing the business, and how to 4. select a suitable business model for the company.

Contents:

The course introduces the concepts of business idea, business plan, software business models and strategies, and the software value network. Case studies vary yearly.

Teaching Methods:

Lectures 6 h, workshops 12 h, seminar presentations 8 h, homeworks and project (pre, course, post) 52h. Total amount 78 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, pre-task, project, essay.

Course Materials:

To be announced in course pages and in lectures.

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

Yes, 40.

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

Yes, 5

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

Yes, 5

CT60A7510: Design Patterns, 6 cp

Validity: 01.08.2017 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Business and Management
Grading: Study modules 0-5,P/F
Teachers: Ajantha Dahanayake

Note:

Can't be included into a same degree as CT60A7501 Object-Oriented Programming Techniques.

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Professor Ajantha Dahanayake

Aims:

The students understand the advanced concepts and techniques of design patterns and object-oriented programing and the application of those concepts and techniques for solving practical problems in programming tasks.

Contents:

The course covers: Design Patterns and their applications, Design rules and Principles, reusability, and reflections by Introduction to Java,
Java run-time object model, composition, inheritance, interfaces, collections and containers.

Teaching Methods:

Period 3: Lectures 14 h, exercises 14 h, exercise & team project preparation 25 h, weekly self-study 25 h.
Period 4: Lectures 14 h, exercises 14 h, exercise & team project preparation 25 h, weekly self-study 25 h.
Total hours 156 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0 - 5. Continuous assessments: Weekly quizzes 10 %, exercises and practical assignment 50 %. Team Project 40%

Course Materials:

Lecture notes. Eckel, B.: Thinking in Java, Prentice Hall. Gamma, E. et al.:

Design Patterns, Addison-Wesley. Freeman, Freeman, Sierra & Bates: Head First Design Patterns, O'Reilly (2004 or newer).

Prerequisites:

CT60A2411 Olio-ohjelmointi (Object-Oriented Programming) or equivalent.

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.

Further information:

Moodle-exam every week.

CS30A7402: Software and Application Innovation, 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: Mirva Hyypiä, Jari Porras, Antti Herala, Helinä Melkas

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

This course combines technology and technology management perspectives for cross-scientific approach in software and application innovation process. After completion of the course students have broader perspective on innovation process in some yearly changing technically focused area. Students know how to innovate new meaningful software solutions and applications based on some technology, and what is the technical and business feasibility of the solution in domestic and international markets.

Contents:

Innovation management, idea generation and opportunity identification process. (Open) business models and technology commercialization in global markets. Product and service development. Basics and use cases of the selected technology, user-centric design and privacy perspectives in software and application development. The course is related to sustainability.

Teaching Methods:

Lectures 14 h. Innovation exercise to be given during the lectures 45 h, practical work (documentation) 45 h, independent group work 44 h, presentations 8 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. Practical work 100 %.
Course Materials:
To be announced later.
Places for exchange-students? (Yes, number/No):
Ýes, 10-15
Places for Open University Students?(Yes, number/No):
No
Related to:
to sustainability

FyDInt300: Technical Physics, 20 - 26 cp

Validity: 01.08.2009 -
Form of study:
Type: Study module
Unit: LUT School of Engineering Science

No course descriptions.

A minimum of 20 ECTS cr should be selected from the courses below.

BM30A0500: Applied Optics, 6 cp

Validity: 01.08.2007 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Engineering Science
Grading: Study modules 0-5,P/F
Teachers: Erik Vartiainen

Year:
M.Sc. (Tech.) 1-2
Period:
2
Teaching Language:
English
Teacher(s) in Charge:
Associate Professor, Ph.D. Erik Vartiainen
Aims:

After the course a student:
1. knows the basic properties of waves and wave motion;
2. understands the material polarization phenomenon as the ultimate source of light;
3. knows the basic properties and physics of laser action;
4. knows the ideas and applications of ultrafast optics;
5. knows the basic physics and applications of nonlinear optics;
6. knows the Fresnel-equations, and understand accordingly the physics of light reflection and refraction;
7. knows the basics of light polarization, the corresponding applications and the Jones matrix formulation;
8. understands the meaning of spatial and temporal coherence of light, and their implications for the technical applications, such as FTIR spectroscopy;
9. knows the ABCD-matrix formulation for geometrical optics;
10. knows the basics of laser imaging: one- and two-photon confocal microscopy, spectral imaging, and fluorescence nanoscopy;
11. understands the physics of producing slow and fast light, and knows their applications;
12. understands diffraction of light, and its applications.

Contents:

1. Wave motion and wave equations;
2. Maxwell equations and electromagnetic spectrum;
3. Lasers;
4. Ultrafast lasers;
5. Fresnell equations;
6. Polarization and optical activity;
7. Geometrical optics;
8. Coherence;
9. Interference and diffraction;
10. Nonlinear optics;
11. Optical microscopy and nanoscopy;
12. Slow and fast light; THz-optics;
13. Attosecond optics;
14. Coherent control.

Teaching Methods:

Lectures 42 h, exercises 14 h, homework 70 h, preparation for the exam 26 h and exam 4 h. total 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:

1. Eugene Hecht, Optics, 4th edition (Addison-Wesley, 2002). 2. G. R. Fowles, Introduction to Modern Optics, 2nd edition, (Holt, Rinehart and Winston, New York, 1976). 3. R. W. Boyd, Nonlinear Optics (Academic Press, San Diego, 1992). 4. Y. R. Shen, The Princples of Nonlinear Optics (Wiley, New York, 1984).

Prerequisites:

Students are recommended to have completed Physics or Physics L.

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

Yes, 20

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

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

BM30A1500: Advanced Topics in Material Science, 6 cp

Validity: 01.08.2007 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Erkki Lähderanta

Year:

M.Sc. (Tech.) 1

Period:

2

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Erkki Lähderanta

Aims:

The aim of the course is to introduce students to selected topics of advanced physics, especially in the area of nanophysics.

Contents:

Nanophysics, applied superconductivity, ferroelectrics, other advanced topics in material science connected to nanophysics.

Teaching Methods:

Lectures 30 h, homework 126 h (5 essays á 25 h 12 min), 2nd period. Total work load 156 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Assessment:

Pass/Fail. Written assignment 100 %.

Course Materials:

To be given at lectures.

Prerequisites:

BM30A2200 Semiconductor and Superconductor Physics

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.

BM30A1600: Microelectronics, 6 cp

Validity: 01.08.2008 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Erkki Lähderanta

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Erkki Lähderanta

Aims:

To acquaint students with integrated circuit technology and provide them with skills for analog IC design. The students will learn the most important variables and functions related to the components of integrated circuits. Components will be modelled with simulation programs. The assignment of IC design will be carried out with a suitable design program.

Contents:

Semiconductor physics for the analysis of the operation of components. The geometry and design rules of IC components. PN junctions, MOS, BJT, and passive components in IC.

Teaching Methods:

Lectures 28 h, tutorials 14 h, preparation for exam 60 h, assignment 54 h, 1st period. Assignment and its presentation. Written examination.

Suitability for doctoral studies (Yes/Leave empty):

Kyllä

Assessment:

0-5, examination 100 %. Satisfactorily completed assignment required.

Course Materials:

Roger T. Howe, Charles G. Sodini: Microelectronics An Integrated Approach.

Prerequisites:

Recommended BL40A1711 Johdanto digitaalielektroniikkaan and BL50A1400 Analogiaelektroniikka.

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.

BM30A1701: Physics of Semiconductor Devices, 6 cp

Validity: 01.08.2013 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Tuure Tuuva

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Tuure Tuuva

Aims:

To provide the student with an in-depth knowledge of semiconductor diode, CCD, MOSFET, LED and photodiode and their operation.

Contents:

Structure, operation and physics of semiconductor devices.

Teaching Methods:

Special assignment 124 h, seminars 28 h, 1st-2nd period.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Assessment:

Pass/fail, special assignment 100 %.

Course Materials:

Sze, Physics of Semiconductor Devices.

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.

BM30A2100: Microelectronics Processing Technology, 2 cp

Validity: 01.08.2009 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Tuure Tuuva

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Tuure Tuuva

Aims:

To provide the student with a basic knowledge of microelectronics processing technology and components. Oxidation, diffusion and metallization.

Contents:

Purification of semiconductor materials. Growth of semiconductor crystals and wafer preparation. Epitaxial layers, diffusion, ion implantation, oxidation, etching and photolithography. Semiconductor manufacturing and development.

Teaching Methods:

Special assignment 52 h.

Assessment:

0-5, seminar and/or written assignment 100 %.

Course Materials:

Plummer, J. D., Deal, M. D., Griffin, P. B., Silicon VLSI Technology: Fundamentals, Practice and Modeling.

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.

BM30A2200: Semiconductor and Superconductor Physics, 6 cp

Validity: 01.08.2009 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Ivan Zakharchuk

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Ivan Zakhachuk

Aims:

The course gives the student the skills to understand the basic behaviour of semiconductors and superconductors.

Contents:

Classical conductor, free-electron model of metals, energy bands, doped semiconductors, spintronics, basic properties of superconductivity, London equations, thermodynamics of the superconducting transition, the intermediate state, coherence length, current in superconductor, thin films, BCS-theory, type-II superconductors.

Teaching Methods:

Lectures 49 h, exercises 28 h, preparing for exercises 49 h, preparing for the exam 30 h. Total work load 156 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Assessment:

0-5, examination 100 %.

Course Materials:

Juha Sinkkonen: Puolijohdeteknologian perusteet. A. C. Rose-Innes and E. H. Rhoderick: Introduction to Superconductivity, 2nd edition (Pergamon).

Prerequisites:

A knowledge of the fundamentals of material physics, a knowledge of the electric and physical properties of materials.

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.

BM30A2500: Nanophysics, 6 cp

Validity: 01.08.2014 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Tatiana Makarova

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, Ph.D. Tatiana Makarova

Aims:

The objective of the course is to make information about the rapidly evolving areas of nanoscale science and technology available to a wide range of students.

Contents:

Introduction, Forces in the Nanoworld, Scalling Laws, Nanochemistry, Nanoelectronics, Nanofluidics, Nanomagnetism, Nanomaterials, Nanomechanics, Nano-optics of Metals, Nano-optics of Semiconductors, Nanothermodynamics, Nanocarbon, Nanoethics.

Teaching Methods:

Lectures 42 h, exercises 28 h, preparing for exercises 46 h, preparing for the examination 40 h, 1st-2nd period.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Assessment:

0–5, exercises 10 %, examination 90 %.

Prerequisites:

Knowledgement about basic solid-state physics.

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.

MaDIntM300: Technomathematics, 20 cp

Validity: 01.08.2009 -

Form of study:

Type: Study module

Unit: LUT School of Engineering Science

No course descriptions.

Choose a minimum of 20 ECTS cr

BM10A1100: Advanced Methods in Mathematics, Computing and Physics, 3 - 6 cp

Validity: 01.08.2016 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Engineering Science
Grading: Study modules 0-5,P/F
Teachers: Erkki Lähderanta, Arto Kaarna, Jouni Sampo

Year:

M.Sc. (Tech.) 2

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, D.Sc. (Tech.) Arto Kaarna, Professor, Ph.D. Erkki Lähderanta, University Lecturer, D. Sc. (Tech.) Jouni Sampo.

Aims:

The student will obtain theoretical and operational skills in some specific area of applied mathematics, computational methods, and technical physics. He understands the methods and knows how to apply the methods to modeling problems in mathematics, science and engineering.

Contents:

The course consists of literature review, working on exercises and completing practical projects. Materials will be chosen and agreed individually according to the focus of the study module, students' interests and research in the laboratories. The course with the same title can be included in the study programme twice when two distinct areas are covered. The course is related to sustainability.

Teaching Methods:

Self-study of learning materials, exercises, project assignment and reporting, seminar presentation, total 80-160 h, 1st-4th period.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Number of mid-term examinations:

0

Assessment:

Pass/Fail, report and seminar presentation 100 %.

Prerequisites:

Recommended: BSc. in Computational Engineering and Technical Physics, first year studies in the specialization of the M.Sc. studies.

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

No

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

No

BM20A3102: Fuzzy Sets and Fuzzy Logic, 6 cp

Validity: 01.08.2017 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Pasi Luukka

Note:

Suitable also for doctoral studies.
Replaces the course BM20A3101 Fuzzy Sets and Fuzzy Logic 6 ECTS cr.

Year:

M.Sc. (Tech.) 1-2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, D.Sc. (Tech.) Pasi Luukka

Aims:

In the end of the course student is expected to be able to understand basic mathematical concepts related to fuzzy set theory and fuzzy logic. Able to model uncertain concepts, create fuzzy models, apply and solve them.

Contents:

The course consists of concept of fuzziness, some algebras of fuzzy sets, fuzzy quantities, logical aspects of fuzzy sets, operations of fuzzy sets, fuzzy relations, fuzzy compositional calculus, aggregation operators, possibility theory, fuzzy inference systems, information uncertainty.

Teaching Methods:

Lectures 28 h, exercises 14 h, 1st period. Lectures 28 h, exercises 14 h, 2nd period. Preparation for exam and the exam 70 h. Altogether 154 h from which independent work 70 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:

Nguyen, H.T., Walker, E.A.: A First Course in Fuzzy Logic, 2nd Ed., Chapman & Hall/CRC, 2000.
Klir, G., Yuan, B.:Fuzzy Sets and Fuzzy Logic. Theory and Applications, Prentice Hall, 1995.
Fullér, R.: Introduction to Neuro-Fuzzy Systems, Physica-Verlag, 2000.

Prerequisites:

Bachelor level basic math courses.

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

No

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

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

BM20A3401: Design of Experiments, 4 cp

Validity: 01.08.2008 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Heikki Haario

Note:

Suitable also for doctoral studies.

Year:

M.Sc. (Tech.) 1-2

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Heikki Haario

Aims:

After the course, the student is expected to master the basic skills for effective experimentation, together with regression analysis of data:
- understanding of the importance of designed experiments
- ability to apply the basic experimental plans, and regression techniques to analyse the results
- skills to optimize an engineering process using design of experiments and data analysis.

Contents:

Importance of experimental design, minimization of prediction uncertainty of regression models. Basic factorial designs: 2N, Central Composite designs for regression analysis. The Taguchi principles. Experimental optimisation of engineering processes.

Teaching Methods:

Lectures 21 h, exercises 14 h, homework 21 h, experimental work in laboratory 26 h, preparation for examination and the examination 22 h, 4th period. Total 104 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Assessment:

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

Course Materials:

Box, G., Hunter, S., Hunter, W. G.: Statistics for Experimenters, Wiley 2005, 2nd Edition.

Prerequisites:

First year university calculus, BM20A1401 Tilastomatematiikka I/basic statistics. Basic (Matlab) skills for technical computing with PC.

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

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

Related to:

to sustainability

BM20A3602: Fuzzy Data Analysis, 6 cp

Validity: 01.08.2010 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Pasi Luukka

Year:

M.Sc. (Tech.) 1-2

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, D.Sc. (Tech.) Pasi Luukka

Aims:

In the end of the course student is expected to be able to
- understand theoretical aspects of data analysis
- understand the principles of multi-criteria decision making and is capable of applying them
- model and analyze uncertainty in different problem settings
- apply fuzzy principal component analysis, fuzzy clustering and classification methods to data analysis problems

Contents:

Fuzzy sets and relations. Uncertainty measures. Qualitative and quantitative analysis of fuzzy data. Introduction to possibility theory and generalized measure theory. Principles of individual multiperson, multicriteria making, fuzzy interpolation, fuzzy principal component analysis, fuzzy clustering and classification, fuzzy regression analysis. Evaluation of methods.

Teaching Methods:

Lectures 28 h, exercises 28 h 3rd period. Project work, 75 h, 4th period. Preparation for exam and the exam 30 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, examination 100 %. Project work.

Course Materials:

Bandemer, H., Näther, W.: Fuzzy Data Analysis, Kluwer Academic Publ., 1992.

Prerequisites:

Recommended BM20A3101 Fuzzy Sets and Fuzzy Logic

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

No

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

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

BM20A5001: Principles of Technical Computing, 4 cp

Validity: 01.08.2014 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Matylda Jablonska-Sabuka

Year:

B.Sc. (Tech.) 2. M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

D.Sc. (Tech.) Matylda Jablonska-Sabuka

Aims:

Students get a good understanding of Matlab syntax and programming, gain fluency in principles of technical computing and are able to apply the skills to basic mathematical and engineering problems (the skills are applicable in big part to Octave and R programming, too).

Contents:

Working with various data structures (multidimensional arrays, cell arrays, etc.) and variable types (numeric, logical, textual, etc.), Matlab symbolic functionality, conditional statements (if-else, switch-case), loops (for and while), using built-in functions, handling external data, 2-D and 3-D plotting, writing user-defined functions, optimization of code speed, style and efficiency.

Teaching Methods:

Lectures 12 h, computer class exercises 24 h, independent study 30 h, preparation for exam 34 h, 1st period. Total 100 h. EXAM-tentti.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

Yes

Assessment:

0-5, examination 100 %.

Course Materials:

Lecture material available in Moodle, based partly on textbook: Gilat, A.: An Introduction to Matlab with Applications.

Prerequisites:

Basic University Calculus required. Recommended first year university calculus necessarily including matrix calculus.

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

Yes, 1-10

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

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

Related to:

to sustainability

BM20A5100: Scientific Computing and Numerics for PDEs, 6 cp

Validity: 01.08.2011 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Joonas Sorvari

Note:

The course will be lectured every other year, next during the academic year 2017-2018. Suitable also for doctoral studies.

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

Yes, 2017-2018

Year:

M.Sc. (Tech.) 2

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Associater Professor, Ph.D. Joonas Sorvari

Aims:

The student knows basic equations of heat transfer and fluid mechanics. The student is able to solve ordinary and partial differential equations using the finite element method, and is able to work with simulation softwares.

Contents:

Equations of heat transfer and fluid mechanics. Variational methods and weak form. Finite element method. Time-dependent problems. Solution of equations. Finite elements in heat transfer and fluid dynamics.

Teaching Methods:

Lectures 18 h, exercises 24 h, self-study 40 h, project assignment 40 h, exam and preparation 10 h, 4th period. Total 132 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, project work 40 %, exam 60 %.

Course Materials:

Lecture notes

Prerequisites:

BM20A2701 Numerical Methods II BM20A5500 Differentiaaliyhtälöt ja dynaamiset systeemit Recommended BM20A4100 Vektorianalyysi teknillisessä laskennassa.

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

Yes, 5

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

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

BM20A6200: Inverse Problems and Normed Spaces, 6 cp

Validity: 01.08.2016 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Jouni Sampo

Note:

Replace courses BM20A2500 Linear Algebra and Normed spaces and BM20A5600 Inverse Problems and Sparse Transforms.

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

University lecturer, D.Sc. (Tech.) Jouni Sampo

Aims:

The student knows the concepts of function spaces and related basic terminology of functional analysis. Student understand and is able to use classical methods for solving linear inverse problems like of estimation of signal from incomplete or corrupted measurements.

Contents:

Vector spaces, bases and linear operators. Linear subspaces and projections. Norms, metric and convergence. Various function spaces, Banach spaces, Lp-spaces, Hilbert spaces. Formulation of inverse problems with additive noise. Ill-posedness and inverse crimes. Truncated singular value decomposition for inverse problems, Tikhonov and total variation regularization.

Teaching Methods:

Lectures 21 h, exercises 14 h, independent study and homework 40 h, 1st period. Lectures 21 h, exercises 14 h, independent study and homework 43 h, 2nd period. Exam 3h. Total 156 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Exam 100%

Course Materials:

Study material will be informed/distributed through the Moodle portal.

Prerequisites:

Basic Matlab skills are required (in 2nd period). BM20A1601 Matrix calculus is recommended.

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

Yes, max 5

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

Yes, max. 15

BM20A6500: Simulation and System Dynamics, 6 cp

Validity: 01.08.2017 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Engineering Science

Grading: Study modules 0-5,P/F

Teachers: Virpi Junttila, Azzurra Morreale

Note:

Suitable also for doctoral studies.
Replaces the course BM20A2000 Simulation 4 ECTS cr.

Year:

M.Sc. (Tech.) 1

Period:

2-3

Teaching Language:

English

Teacher(s) in Charge:

Post-Doctoral Researcher, D.Sc. (Tech.) Virpi Junttila
Post-Doctoral Researcher, Ph.D. Azzurra Morreale

Aims:

The course gives an introduction to the concepts of discrete and continuous simulation models and methods together with numerical examples. After the course, the student is able to create and use different simulation models to solve practical problems. Among the discrete-event based models, the student is able to model basic queuing, server, scheduling and storage size problems. Also, the student is able to create basic operations and model dynamic systems with Simulink and use Simulink to solve different simulation problems.

Contents:

Basic concepts of discrete and continuous systems. Model-based design, basic modeling work-flow, basic simulation work-flow, running the simulations and interpreting the results. Random numbers, discrete event generation by random numbers. Statistical and empirical distributions for event generation. Building numerical simulation examples with Matlab and Simulink. Modeling dynamics systems and simulation models for dynamic systems with Simulink.
Application examples: queuing systems, storage size optimization, profitability analysis, supply chain management, investment analysis

Teaching Methods:

Lectures 21 h, exercises 14 h, homework 21 h, 2nd period. Lectures 21 h, exercises 14 h, homework 21 h, 3rd period. Practical assignment 22 h, preparation for examination and the examination 22 h, 2nd-3rd period. Total 156 h.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Examination in Examination schedule (Yes/No):

Yes

Assessment:

0-5, examination 80 %, homework and practical assignment 20 %.

Prerequisites:

Recommended BM20A1401 Tilastomatematiikka I.

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

No

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

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