Catalogue report

LUT School of Engineering Science

Master's Programme in Computational Engineering and Technical Physics

Master’s Programme in Computational Engineering and Technical Physics 2017-2018 (120 ECTS cr)

Facts

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

Learning Outcomes of the MSc Programme in Computational Engineering and Technical Physics

After the completion of the MSc programme in Computational Engineering and Technical Physics the student will obtain sufficient mathematical and computational skills for industry and other research and development tasks.

The students will

- be able to apply scientific methods to work
- master the advanced knowledge and skills involving major subject
- be able to work as experts, developers and researchers
- understand the fundamentals of minor subject

In addition, **Technomathematics** graduates will

- be able to describe systems and processes in the form of mathematical models
- possess symbolic data analysis and numerical analysis skills for mathematical equations and expressions
- be able to apply numerous applied mathematics techniques
- be able to apply statistical theory to study and describe the uncertainty of models and observations
- be able to use computational software to simulate and visualise models

In addition, **Technical Physics** graduates will

- have an advanced knowledge of physics
- be familiar with the scientific literature and research in the field
- be able to collaborate internationally with physics researchers
- master empirical research principles and laboratory practices
- be able to apply advanced measurement techniques
- be familiar with modern physics and material science
- have a knowledge of the application of physics in industry and other sectors of society

In addition, **Intelligent Computing** graduates will

- be able to analyse challenging information processing problems and solve them algorithmically
- have strong programming skills to implement information technology solutions
- be able to apply intelligent information processing methods to solve information processing problems
- be able to choose and apply methods of machine vision, computer graphics, machine learning and artificial intelligence
- understand the importance of science in mathematical modelling and the application of methods

Degree Structure

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

This MSc in Computational Engineering and Technical Physics 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 with the exception of technomathematics. Students specialising in technomathematics make their personal study plans otherwise than in weboodi.

See Uni-portal:
Computational Engineering and Techical Physics

Degree structures

Degree Structure

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

Students may choose any minor offered by LUT (check the required prerequisites, if any) or do the minor during exchange abroad (upon application). The students of Computational Engineering and Technical Physics have recommendations on how to choose the minor:

- TuSOYritt Yrittäjyys (in Finnish)
- TiDSOSE Software Engineering (extensive)
- SaSaM101 Sähkötekniikka, laaja (in Finnish)
- TuSOEntr Entrepreneurship or
- TuSOMBAN Business Analytics

Free elective studies can be any courses offered by LUT if the required prerequisites are fulfilled. Studies in other universities/from abroad or a max. of 10 ECTS of internship (BM10A0100 Work Internship in Master's Degree, 2-10 ECTS) may be included upon application, too.

The MSc in Computational Engineering and Technical Physics 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 with the exception of technomathematics. Students specialising in technomathematics make their personal study plans otherwise than in weboodi.

See the degree structure for details.

Master's Programme for Double Degree Students / Major in Intelligent Computing 2017-2018

Degree structure status: published

Academic year: 2017-18

Beginning date of the academic year: 01.08.2017

Cores Studies (min 0 cp)

Specialisation Studies (min 70 cp)

MaDMa300: Intelligent Computing, 66 cp
- *Specialisation studies in Intelligent Computing consists of obligatory studies (57 ECTS cr) and alternative studies (13 ECTS cr*
  - BM10A0000: Master's Thesis and Seminar, 30 cp
  - BM40A0701: Pattern Recognition, 6 cp
  - BM40A1001: Seminar on Intelligent Computing, 3 cp
  - BM40A1201: Digital Imaging and Image Preprocessing, 6 cp
  - BM40A1400: GPGPU Computing, 6 cp
- *Exchangeable courses*
  - BM40A0801: Machine Vision and Digital Image Analysis, 6 cp
  - BM40A0901: Computer Vision, 6 cp
- *Choose min. 13 ECTS cr from following studies.*
  - BL40A1601: Embedded System Design, 6 cp
  - BM10A0500: Research Methods, 3 cp
  - BM10A0601: Research Methods, Laboratory Project, 1 - 6 cp
  - 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
  - BM20A4701: Modelling with Partial Differential Equations, 4 cp
  - BM20A6100: Advanced Data Analysis and Machine Learning, 6 cp
  - BM20A6200: Inverse Problems and Normed Spaces, 6 cp
  - BM30A0500: Applied Optics, 6 cp
  - BM30A0601: Optoelectronics, 6 cp

Credit Transfer

Free Elective Studies

Possible extra courses, students are recommended to study BM10A1200 Introduction to M.Sc. Studies in Computational Engineering and Technical Physics and at least one course of Finnish, FV18A9101 Finnish 1 (2 ECTS cr).

Master's Programme for Double Degree Students / Major in Technical Physics 2017-2018

Degree structure status: published

Academic year: 2017-18

Beginning date of the academic year: 01.08.2017

Core Studies

Specialisation Studies (min 70 cp)

FyDMa200: Technical Physics, 66 cp
- *Specialisation studies in Technical Physics consists of obligatory studies (66 ECTS cr) and alternative studies (4 ECTS cr*
  - BM10A0000: Master's Thesis and Seminar, 30 cp
  - BM30A0500: Applied Optics, 6 cp
  - BM30A0601: Optoelectronics, 6 cp
  - BM30A1500: Advanced Topics in Material Science, 6 cp
  - BM30A1600: Microelectronics, 6 cp
  - BM30A2200: Semiconductor and Superconductor Physics, 6 cp
  - BM30A2500: Nanophysics, 6 cp
- *Choose min. 4 ECTS cr from following studies.*
  - BM20A5001: Principles of Technical Computing, 4 cp
  - BL40A1101: Embedded System Programming, 5 cp

Credit transfer

Free Elective Studies

Possible extra courses, students are recommended to study BM10A1200 Introduction to M.Sc. Studies in Computational Engineering and Technical Physics and at least one course of Finnish, FV18A9101 Finnish 1 (2 ECTS cr).

Master's Programme in Computational Engineering and Technical Physics 2017-2018 (muok. 29.6.2017)

Degree structure status: published

Academic year: 2017-18

Beginning date of the academic year: 01.08.2017

Core Studies (min 7 cp)

LaDCore: Core Studies, 5 - 30 cp
- *Obligatory Studies 7-12 ECTS cr*
  - BM10A0500: Research Methods, 3 cp
  - BM20A3401: Design of Experiments, 4 cp
- *Only for students who have no Matlab programming courses in earlier studies*
  - BM20A5001: Principles of Technical Computing, 4 cp
- *Only for students coming outside of LUT*
  - BM10A1200: Introduction to M.Sc. Studies in Computational Engineering and Technical Physics, 1 cp

Specialisation Studies (min 70 cp)

Choose one specialization studies from the following.

Aim of studies in technomathematics is to learn mathematical methods to model and analyse real world problems arising from wide range of application fields, for example industry and environmental processes and economics.

Studies in technical physics will focus on materials physics, nanophysics, semiconductors, superconductors, spintronics and optical measurement technologies.

In Intelligent Computing the student will get familiar with methods in computer vision and pattern recognition and how to implement them in industrial applications. The studies concentrate in intelligent and learning methods in computing. Data analytics, feature detection and classification are on the background of the practical applications.

Technical Physics

FyDMa100: Technical Physics, 65 - 74 cp
- *Obligatory Studies 74 ECTS cr*
  - BM10A0000: Master's Thesis and Seminar, 30 cp
  - BM30A0500: Applied Optics, 6 cp
  - BM30A0601: Optoelectronics, 6 cp
  - BM30A1500: Advanced Topics in Material Science, 6 cp
  - BM30A1600: Microelectronics, 6 cp
  - BM30A1701: Physics of Semiconductor Devices, 6 cp
  - BM30A2200: Semiconductor and Superconductor Physics, 6 cp
  - BM30A2500: Nanophysics, 6 cp
  - BL50A0600: Electromagnetic Compatibility in Power Electronics, 2 cp

Intelligent Computing

MaDMa200: Intelligent Computing, 70 cp
- *Specialisation studies in Intelligent Computing consists of obligatory studies (63 ECTS cr) and alternative studies (11 ECTS cr).*
  - BM10A0000: Master's Thesis and Seminar, 30 cp
  - BM20A6100: Advanced Data Analysis and Machine Learning, 6 cp
  - BM40A1400: GPGPU Computing, 6 cp
  - BM40A0701: Pattern Recognition, 6 cp
  - BM40A1001: Seminar on Intelligent Computing, 3 cp
  - BM40A1201: Digital Imaging and Image Preprocessing, 6 cp
- *Exchangeable courses, choose one of the following courses*
  - BM40A0801: Machine Vision and Digital Image Analysis, 6 cp
  - BM40A0901: Computer Vision, 6 cp
- *Alternative studies. Choose at least 11 ECTS cr from following studies*
  - BL40A1100: Embedded System Programming, 4 cp
  - BM10A0601: Research Methods, Laboratory Project, 1 - 6 cp
  - 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
  - BM20A3602: Fuzzy Data Analysis, 6 cp
  - BM20A6200: Inverse Problems and Normed Spaces, 6 cp
  - BM30A0500: Applied Optics, 6 cp
  - BM30A0601: Optoelectronics, 6 cp

Technomathematics

MaDMa100: Technomathematics, 70 - 76 cp
- *Specialisation studies in Technomathematics consists of obligatory studies (64 ECTS cr) and alternative studies (10 ECTS cr).*
  - BM10A0000: Master's Thesis and Seminar, 30 cp
  - BM20A3001: Statistical Analysis in Modelling, 5 cp
  - BM20A4000: Case Study Seminar, 5 cp
  - BM20A6100: Advanced Data Analysis and Machine Learning, 6 cp
  - BM20A6200: Inverse Problems and Normed Spaces, 6 cp

BM20A6500: Simulation and System Dynamics, 6 cp
CS38A0020: Optimization in business and industry, 6 cp

Alternative studies. Choose at least 10 ECTS cr from following studies.

BJ02A2011: Modelling of Unit Operations, 5 cp
BM10A1100: Advanced Methods in Mathematics, Computing and Physics, 3 - 6 cp
BM20A3102: Fuzzy Sets and Fuzzy Logic, 6 cp
BM20A3602: Fuzzy Data Analysis, 6 cp
BM20A4701: Modelling with Partial Differential Equations, 4 cp
BM20A5100: Scientific Computing and Numerics for PDEs, 6 cp
BM40A1400: GPGPU Computing, 6 cp
CS38A0010: Free analytics environment R, 6 cp

Minor Studies (min 20 cp)

Students may choose any minor studies taught at LUT if the required prerequisites are fulfilled. Recommeded minor studies are minor studies in Yrittäjyys (TuSOYritt), Software Engineering (TiDSOSE), Sähkötekniikka, laaja (SaSaM101), Entrepreneurship (TuSOEntr) and Business Analytics (TuSOMBAN).

Free Elective Studies

Choose enough free elective studies to attain the full 120 ECTS cr. Free elective studies can include any courses offered by LUT if the required prerequisites are fulfilled. Students may include an internship that improves professional skills to free elective studies. An internship may be worth a maximum of 10 ECTS credits. More information: BM10A0100 Work Internship in Master's Degree. Students are recommended to study language studies and courses in Finnish language.

Courses and study modules not included in degree structures

Minor Studies

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

The students of Computational Engineering and Technical Physics have recommendations on how to choose the minor:

- TuSOYritt Yrittäjyys (in Finnish)
- TiDSOSE Software Engineering (extensive)
- SaSaM101 Sähkötekniikka, laaja (in Finnish)
- TuSOEntr Entrepreneurship or
- TuSOMBAN Business Analytics

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

Energy Technology:
EnSaM100 Energiatekniikka (in Finnish)
EnSaM150 Energiatekniikka, laaja (in Finnish)
EnDSaBT Bio-Energy Technology
EnDMES Modelling of Energy Systems

Environmental Technology:
YmKSaYmte Ympäristötekniikka (in Finnish)
YmDSaResp Environmental Responsibility

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

Electrical Engineering:
SaSaM100 Sähkötekniikka (in Finnish)
SaDSaIE Industrial Embedded Systems
SaDREE Renewable Energy and Energy Efficiency
SaDSaEDM2 Power Electronics and Electrical Drives

Industrial Engineering and Management:
TuKSOTekn Tuotantotalous, sivuopinnot muu tekniikka (in Finnish)
TuDSO Tuotantotalous, sivuopinnot laaja (in Finnish)

Computer Science:
TikSOTite Tietotekniikka (in Finnish)

Business Administration:
KaSOLiik Liiketoimintaoaaminen (in Finnish)
KaSOIbm International Business and Management.

Chemical and Process Engineering:
KeSoM200 Kemia (in Finnish)
KeSoM300 Kemian prosessitekniikka (in Finnish)

SaSaM101: , 20 cp
- *Vaihtoehtoiset moduulit, valitse yhdestä moduulista opintojaksoja vähintään 20 op. Esitietovaatimuksena Sähkötekniikka sivuopintojen suorittaminen.*
  - SaSoSaMa: Electricity Market, 20 cp
    - *Valinnainen moduuli, valitse vähintään 20 op opintojaksoja.*
      - BL10A8400SS: Solar Economy and Smart Grids, 3 cp
      - BL20A0201: Power Exchange Game for Electricity Markets, 3 cp
      - BL20A0400: Electricity Market, 5 cp
      - BL40A2301: Energy Efficiency, 6 cp
      - BL40A2401: Electrical Engineering in Wind and Solar Systems, 6 cp
  - SaSoELE: Electronics, 20 cp
    - *Valinnainen moduuli, valitse vähintään 20 op opintojaksoja.*
      - BL50A0802: Electronic Equipment and Systems Design, 7 cp
      - BL50A0900: Analog Signal Processing, 6 cp
      - BL50A1300: Advanced Course in Electronics, 6 cp
      - BL50A1400: Analog Electronics, 6 cp
      - BL50A1600: Electronics, Laboratory Course 2, 3 - 6 cp
      - BL50A1700: Electronics project, 2 - 8 cp

TuSOYritt: , 20 - 35 cp
- *Obligatory*
  - CS34A0302: Entrepreneurship Theory, 6 cp
  - CS34A0732: New Venture Creation, 6 cp
- *Selectable*
  - CS30A1372: Creative Design and Problem Solving, 6 cp
  - CS34A0401: Strategic Entrepreneurship in an Age of Uncertainty, 6 cp
  - CS34A0551: Business Idea Development, 6 cp

A330A5101SS: Creativity and Entrepreneurship in New Product Development from Silicon Valley's Perspectives, 3 cp
CS30A1691: Social Sustainability, 6 cp
CS34A0721: Entrepreneurship, ownership and family firms, 6 cp
CS34A0351: Entrepreneurial growth and development, 6 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

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

Course descriptions

Descriptions of courses and study modules included in the degree structures

MaDMa300: Intelligent Computing, 66 cp

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

No course descriptions.

Specialisation studies in Intelligent Computing consists of obligatory studies (57 ECTS cr) and alternative studies (13 ECTS cr

BM10A0000: Master's Thesis and Seminar, 30 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: Arto Kaarna

Year:

M.Sc. (Tech.) 2

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

Student has general knowledge about a specific field of engineering and applied science in modern society and is able to apply scientific knowledge and methods in the field of the study. The student is able to work independently, prepare a research plan, complete the designed reseach, and operate in a disciplined way.

Contents:

The Master’s thesis is the final project of the Master’s degree, which demonstrates the student’s knowledge of a topic of scientific or societal importance. The thesis is a research or an implementation project. A report is prepared following the instructions for the Master’s thesis. The report contains description of the problem and the context, the used methods, describes the actual analysis and actions in the implementation, provides the results and evaluates the outcomes and conclusions.

Teaching Methods:

The student works independently and keeps contact with the supervisor informing and discussing the progress of the work. The thesis work is presented in a seminar with other thesis students and their instructors. The student gives a short presentation on the results of his/her project. The presentations are discussed and reviewed. Research work 300 h, independent study 200 h, report preparation 200 h.

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:

0-5, Master's thesis 100 %.

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

No

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

No

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.

BM40A1001: Seminar on Intelligent Computing, 3 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: Heikki Kälviäinen

Note:

Replaces the course BM40A1000

Year:

M.Sc. (Tech.) 2

Period:

2-3

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 basic principles of scientific work and its reporting both in the scientific forums and general media, to understand the principles of the academic thesis and possibilities of funding and different relevant work places, to write a seminar report about intelligent computing in the form of the academic thesis, to give the corresponding oral seminar presentation, and to act as an opponent.

Contents:

The first part (lectures in 2nd period) provides the skills defined in the aims of the course, including the skills to prepare and give the seminar presentation in the second part (3rd period). Independent preparation of a written seminar on a given intelligent computing topic.

Teaching Methods:

Lectures 8 h, 2nd period. Seminars 8 h, 3rd period. Preparing a written and oral seminar presentation, including self-study of relevant literature, and acting as an opponent, 62 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, written seminar report 100 %. Seminar presentation. Active participation to all seminar sessions. Acting as an opponent.

Course Materials:

Material published on the course web page.

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

No

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

No

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: Erik Vartiainen, Tuure Tuuva, 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, 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.

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: Aleksandr Bibov, Arto Kaarna

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.

Exchangeable courses

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.

Choose min. 13 ECTS cr from following studies.

BL40A1601: Embedded System Design, 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, Juhamatti Korhonen

Year:

M.Sc. (Tech.) 1

Period:

3-4

Teaching Language:

English

Teacher(s) in Charge:

D.Sc. (Tech.) Juhamatti Korhonen

Aims:

Upon completion of the course the student will be able to program with VHDL hardware design language and design and implement digital systems by using programmable logic circuits.

Contents:

Circuit design of digital electronics with programmable logic circuits. Principles of digital circuit design, system level synthesis, hardware design languages.

Teaching Methods:

Lectures 14 h, exercises, 14 h, 3st period. Lectures 14 h, exercises, 14 h, assignment, 4nd period. 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 25 %, assignments 75 %.

Prerequisites:

Basics of digital design and digital electronics, basics of programming.

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

Yes, 15

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.

BM10A0500: Research Methods, 3 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: Arto Kaarna

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

Student is able to describe concepts and methods in research. Student knows what is required in scientific reporting and is able to evaluate the structure and contents of a scientific report. Student is able to prepare a research plan.

Contents:

Categorization of science, scientific work. Philosophies behind research. Research process, designing research, research questions and hypothesis. Qualitative and quantitative research methods, data collection. Information retrieval, literature review. Reporting scientific work.

Teaching Methods:

Lectures and exercises 14h, seminars 4h, 1st period. Practical assignment 35 h, 1st and 2nd period. Self-study 22 h, exam 3 h. Total 78 h. 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:

0

Assessment:

0-5, exam 60 %, practical assignments 40 %.

Course Materials:

Creswell, J.W.: Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 4th edition, SAGE, 2014. Hirsjärvi, S., Remes, P., Sajavaara, P.: Tutki ja kirjoita, 15.-16. painos, Tammi, 2010. Research reports.

Prerequisites:

B.Sc. studies finished.

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.

BM10A0601: Research Methods, Laboratory Project, 1 - 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

Note:

Replaces the course BM10A0600

Year:

M.Sc. (Tech.) 1

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

Post-Doctoral Researcher, D.Sc. (Tech.) Virpi Junttila, Associate Professor, D.Sc. (Tech.) Arto Kaarna, Professor, Ph.D. Erkki Lähderanta

Aims:

Student is able to execute a well-defined research task in Technical Physics, Technomathematics, or Intelligent Computing.

Contents:

Research work in the topic defined by the laboratory. When starting the course contact one of the professors according to your major subject: Technomathematics, Virpi Junttila, Intelligent Computing, Arto Kaarna, Technical Physics, Erkki Lähderanta.

Teaching Methods:

Participation in the work of the research group, 1st-4th period. Total 26-156 h.

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:

Passed/failed. Research report and seminar presentation.

Course Materials:

Scientific articles related to the research topic, agreed with the supervisor of the project.

Prerequisites:

BM10A0500 Research Methods.

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

No

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

No

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: Arto Kaarna, Erkki Lähderanta, 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.

BM20A4701: Modelling with Partial Differential Equations, 4 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: Tuomo Kauranne

Year:

M.Sc. (Tech.) 1-2 or Doctoral studies

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, Ph.D. Tuomo Kauranne

Aims:

The student is able to formulate PDE-models, knows fundaments of theory, basic model types and most common numerical schemes, and is able to perform numerical solution using mathematical software tools. The student familiar with a number of application areas. He/she is able to analyze PDE models in multiphysical phenomena, examples are acoustics, solidification and free-boundary computations, crystal growth and impedance tomography

Contents:

Introduction to PDE:s, basics of finite element method, multiphysics and modeling, examples.

Teaching Methods:

Supervised self study course: supervision 5 h, self study 55 h, exam and preparation 10 h, 2nd period. Total 70 h. The course is available in Finnish language as web-course http://hlab.ee.tut.fi/mallinnus/kurssit.

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 100 %

Course Materials:

Endre Suli: Lecture notes on finite element methods for partial differential equations, chapters 1-3 and 5.

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.

Related to:

to sustainability

BM20A6100: Advanced Data Analysis and Machine Learning, 6 cp

Validity: 01.08.2015 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Engineering Science
Grading: Study modules 0-5,P/F
Teachers: Lasse Lensu, Heikki Haario

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Heikki Haario

Aims:

The student can pre-process, visualise and analyse multivariate synthetic and real-world data. The student is able to understand and use state-of-the-art regression methods, graphical models and deep learning. The student can use selected methods to solve a practical assignment, analyse the results and report the findings.

Contents:

Characteristics of data sources, and data pre-processing, dimensionality reduction and outlier detection. Principal component and other advanced regression methods. Graphical models and Bayesian networks. Deep learning and convolutional neural networks. Case-based topics on advanced data analysis by visiting lecturers.

Teaching Methods:

Preparation for lectures 7 h, lectures 14 h, preparation for exercise 21 h, exercises 14 h, 1st period. Preparation for lectures 7 h, lectures 14 h, preparation for exercise 21 h, exercises 14 h, practical assignment 36 h, 2nd period. Self-study 5 h. Exam 3 h. Total amount 156 h.

Assessment:

0-5, exam 50 %, exercises 25 %, practical assignment 25 %.

Course Materials:

Lecture notes in Moodle. Other literature will be announced when the course starts.

Prerequisites:

Recommended: BM20A1901 Statistics II, BM20A2701 Numerical Methods II, BM20A3001 Statistical Analysis in Modelling, BM40A0700 Pattern Recognition or equivalent knowledge.

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

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.

BM30A0601: Optoelectronics, 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: Erkki Lähderanta

Year:
M.Sc. (Tech.) 1
Period:
1
Teaching Language:
English
Teacher(s) in Charge:
Professor, Ph.D. Erkki Lähderanta
Aims:
To understand the basics of optical data communication. Construction of wave guides using total internal reflection and working principals of light emitting diodes and photodetectors.
Contents:
Optical waveguides, light emitting devices and photodetectors.
Teaching Methods:
Lectures 35 h, exercises 14 h, preparation for exam 107 h, 1st period. Examination.
Suitability for doctoral studies (Yes/Leave empty):
Yes
Assessment:
0-5, examination 100 %.
Course Materials:
Kasap, S. O.: Optoelectronics and Photonics P. Silfsten & E. Vartiainen: Optoelektroniikka,
Prerequisites:
Physics or Physics L.
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.

FyDMa200: Technical Physics, 66 cp

Validity: 01.08.2011 -
Form of study: Major studies
Type: Study module
Unit: LUT School of Engineering Science

No course descriptions.

Specialisation studies in Technical Physics consists of obligatory studies (66 ECTS cr) and alternative studies (4 ECTS cr

BM10A0000: Master's Thesis and Seminar, 30 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: Arto Kaarna

Year:

M.Sc. (Tech.) 2

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

Student has general knowledge about a specific field of engineering and applied science in modern society and is able to apply scientific knowledge and methods in the field of the study. The student is able to work independently, prepare a research plan, complete the designed reseach, and operate in a disciplined way.

Contents:

The Master’s thesis is the final project of the Master’s degree, which demonstrates the student’s knowledge of a topic of scientific or societal importance. The thesis is a research or an implementation project. A report is prepared following the instructions for the Master’s thesis. The report contains description of the problem and the context, the used methods, describes the actual analysis and actions in the implementation, provides the results and evaluates the outcomes and conclusions.

Teaching Methods:

The student works independently and keeps contact with the supervisor informing and discussing the progress of the work. The thesis work is presented in a seminar with other thesis students and their instructors. The student gives a short presentation on the results of his/her project. The presentations are discussed and reviewed. Research work 300 h, independent study 200 h, report preparation 200 h.

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:

0-5, Master's thesis 100 %.

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

No

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

No

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.

BM30A0601: Optoelectronics, 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: Erkki Lähderanta

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Erkki Lähderanta

Aims:

To understand the basics of optical data communication. Construction of wave guides using total internal reflection and working principals of light emitting diodes and photodetectors.

Contents:

Optical waveguides, light emitting devices and photodetectors.

Teaching Methods:

Lectures 35 h, exercises 14 h, preparation for exam 107 h, 1st period. Examination.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Assessment:

0-5, examination 100 %.

Course Materials:

Kasap, S. O.: Optoelectronics and Photonics P. Silfsten & E. Vartiainen: Optoelektroniikka,

Prerequisites:

Physics or Physics L.

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.

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.

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.

Choose min. 4 ECTS cr from following studies.

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

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: Jouni Vuojolainen, Teemu Sillanpää, Tuomo Lindh

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.

LaDCore: Core Studies, 5 - 30 cp

Validity: 01.01.2016 -

Form of study:

Type: Study module

Unit: LUT School of Engineering Science

No course descriptions.

Obligatory Studies 7-12 ECTS cr

BM10A0500: Research Methods, 3 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: Arto Kaarna

Year:

M.Sc. (Tech.) 1

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

Student is able to describe concepts and methods in research. Student knows what is required in scientific reporting and is able to evaluate the structure and contents of a scientific report. Student is able to prepare a research plan.

Contents:

Categorization of science, scientific work. Philosophies behind research. Research process, designing research, research questions and hypothesis. Qualitative and quantitative research methods, data collection. Information retrieval, literature review. Reporting scientific work.

Teaching Methods:

Lectures and exercises 14h, seminars 4h, 1st period. Practical assignment 35 h, 1st and 2nd period. Self-study 22 h, exam 3 h. Total 78 h. 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:

0

Assessment:

0-5, exam 60 %, practical assignments 40 %.

Course Materials:

Creswell, J.W.: Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 4th edition, SAGE, 2014. Hirsjärvi, S., Remes, P., Sajavaara, P.: Tutki ja kirjoita, 15.-16. painos, Tammi, 2010. Research reports.

Prerequisites:

B.Sc. studies finished.

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.

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

Only for students who have no Matlab programming courses in earlier studies

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

Only for students coming outside of LUT

BM10A1200: Introduction to M.Sc. Studies in Computational Engineering and Technical Physics, 1 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: Arto Kaarna, Marja Talikka

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, D.Sc. (Tech.) Arto Kaarna
Information Specialist M.Sc. (Tech.) Marja Talikka

Aims:

The course provides information on studying at LUT in the specific degree programme. The course supports the student to organize and schedule her/his M.Sc. studies. In practical level, two main subjects are addressed:
A) The course provides the student with basic knowledge of studying at LUT in general and particularly in his/her degree programme. The course supports the student to plan and complete a personal study plan and to follow the progress of his/her studies according to the personal study plan.
B) Students will learn how to find electronic material from the Academic Library services, collections and databases. Students will learn to use needed digital services and different distance learning applications.

Contents:

The Orientation Days activities. Practical study-related information, degree requirements. Planning of Master's studies. Preparation of the electronic personal study plan at the ePSP workshop. Getting familiar with support in monitoring the progress of the studies. Use of digital services in studies. The Academic Library collections and databases.

Teaching Methods:

Participation in the Orientation Days activities. Library introduction lectures, library use; information sources, information retrieval, and assignments. Assignments on general information about Master Studies. Using Moodle. ePSP workshop, meetings with the Academic Director and Study Councellor. Independent study. Total workload 26 h, 1. period.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

Pass/Fail. Active participation, assignments. ePSP completed.

Course Materials:

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

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

No

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

No

FyDMa100: Technical Physics, 65 - 74 cp

Validity: 01.08.2009 -
Form of study: Major studies
Type: Study module
Unit: LUT School of Engineering Science

No course descriptions.

Obligatory Studies 74 ECTS cr

BM10A0000: Master's Thesis and Seminar, 30 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: Arto Kaarna

Year:

M.Sc. (Tech.) 2

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

Student has general knowledge about a specific field of engineering and applied science in modern society and is able to apply scientific knowledge and methods in the field of the study. The student is able to work independently, prepare a research plan, complete the designed reseach, and operate in a disciplined way.

Contents:

The Master's thesis is the final project of the Master's degree, which demonstrates the student's knowledge of a topic of scientific or societal importance. The thesis is a research or an implementation project. A report is prepared following the instructions for the Master's thesis. The report contains description of the problem and the context, the used methods, describes the actual analysis and actions in the implementation, provides the results and evaluates the outcomes and conclusions.

Teaching Methods:

The student works independently and keeps contact with the supervisor informing and discussing the progress of the work. The thesis work is presented in a seminar with other thesis students and their instructors. The student gives a short presentation on the results of his/her project. The presentations are discussed and reviewed. Research work 300 h, independent study 200 h, report preparation 200 h.

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:

0-5, Master's thesis 100 %.

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

No

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

No

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.

BM30A0601: Optoelectronics, 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: Erkki Lähderanta

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Erkki Lähderanta

Aims:

To understand the basics of optical data communication. Construction of wave guides using total internal reflection and working principals of light emitting diodes and photodetectors.

Contents:

Optical waveguides, light emitting devices and photodetectors.

Teaching Methods:

Lectures 35 h, exercises 14 h, preparation for exam 107 h, 1st period. Examination.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Assessment:

0-5, examination 100 %.

Course Materials:

Kasap, S. O.: Optoelectronics and Photonics P. Silfsten & E. Vartiainen: Optoelektroniikka,

Prerequisites:

Physics or Physics L.

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.

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.

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.

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

MaDMa200: Intelligent Computing, 70 cp

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

No course descriptions.

Specialisation studies in Intelligent Computing consists of obligatory studies (63 ECTS cr) and alternative studies (11 ECTS cr).

BM10A0000: Master's Thesis and Seminar, 30 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: Arto Kaarna

Year:

M.Sc. (Tech.) 2

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

Student has general knowledge about a specific field of engineering and applied science in modern society and is able to apply scientific knowledge and methods in the field of the study. The student is able to work independently, prepare a research plan, complete the designed reseach, and operate in a disciplined way.

Contents:

The Master’s thesis is the final project of the Master’s degree, which demonstrates the student’s knowledge of a topic of scientific or societal importance. The thesis is a research or an implementation project. A report is prepared following the instructions for the Master’s thesis. The report contains description of the problem and the context, the used methods, describes the actual analysis and actions in the implementation, provides the results and evaluates the outcomes and conclusions.

Teaching Methods:

The student works independently and keeps contact with the supervisor informing and discussing the progress of the work. The thesis work is presented in a seminar with other

thesis students and their instructors. The student gives a short presentation on the results of his/her project. The presentations are discussed and reviewed. Research work 300 h, independent study 200 h, report preparation 200 h.

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:

0-5, Master's thesis 100 %.

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

No

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

No

BM20A6100: Advanced Data Analysis and Machine Learning, 6 cp

Validity: 01.08.2015 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Engineering Science
Grading: Study modules 0-5,P/F
Teachers: Lasse Lensu, Heikki Haario

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Heikki Haario

Aims:

The student can pre-process, visualise and analyse multivariate synthetic and real-world data. The student is able to understand and use state-of-the-art regression methods, graphical models and deep learning. The student can use selected methods to solve a practical assignment, analyse the results and report the findings.

Contents:

Characteristics of data sources, and data pre-processing, dimensionality reduction and outlier detection. Principal component and other advanced regression methods. Graphical models and Bayesian networks. Deep learning and convolutional neural networks. Case-based topics on advanced data analysis by visiting lecturers.

Teaching Methods:

Preparation for lectures 7 h, lectures 14 h, preparation for exercise 21 h, exercises 14 h, 1st period. Preparation for lectures 7 h, lectures 14 h, preparation for exercise 21 h, exercises 14 h, practical assignment 36 h, 2nd period. Self-study 5 h. Exam 3 h. Total amount 156 h.

Assessment:

0-5, exam 50 %, exercises 25 %, practical assignment 25 %.

Course Materials:

Lecture notes in Moodle. Other literature will be announced when the course starts.

Prerequisites:

Recommended: BM20A1901 Statistics II, BM20A2701 Numerical Methods II, BM20A3001 Statistical Analysis in Modelling, BM40A0700 Pattern Recognition or equivalent knowledge.

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.

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: Aleksandr Bibov, Arto Kaarna

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.

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.

BM40A1001: Seminar on Intelligent Computing, 3 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: Heikki Kälviäinen

Note:

Replaces the course BM40A1000

Year:

M.Sc. (Tech.) 2

Period:

2-3

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 basic principles of scientific work and its reporting both in the scientific forums and general media, to understand the principles of the academic thesis and possibilities of funding and different relevant work places, to write a seminar report about intelligent computing in the form of the academic thesis, to give the corresponding oral seminar presentation, and to act as an opponent.

Contents:

The first part (lectures in 2nd period) provides the skills defined in the aims of the course, including the skills to prepare and give the seminar presentation in the second part (3rd period). Independent preparation of a written seminar on a given intelligent computing topic.

Teaching Methods:

Lectures 8 h, 2nd period. Seminars 8 h, 3rd period. Preparing a written and oral seminar presentation, including self-study of relevant literature, and acting as an opponent, 62 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, written seminar report 100 %. Seminar presentation. Active participation to all seminar sessions. Acting as an opponent.

Course Materials:

Material published on the course web page.

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

No

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

No

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: Erik Vartiainen, Tuure Tuuva, 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, 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.

Exchangeable courses, choose one of the following courses

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.

Alternative studies. Choose at least 11 ECTS cr from following studies

BL40A1100: Embedded System Programming, 4 cp

Validity: 01.08.2007 - 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:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Associate professor, D.Dc. (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.

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.

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 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.

BM10A0601: Research Methods, Laboratory Project, 1 - 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

Note:

Replaces the course BM10A0600

Year:

M.Sc. (Tech.) 1

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

Post-Doctoral Researcher, D.Sc. (Tech.) Virpi Junttila, Associate Professor, D.Sc. (Tech.) Arto Kaarna, Professor, Ph.D. Erkki Lähderanta

Aims:

Student is able to execute a well-defined research task in Technical Physics, Technomathematics, or Intelligent Computing.

Contents:

Research work in the topic defined by the laboratory. When starting the course contact one of the professors according to your major subject: Technomathematics, Virpi Junttila, Intelligent Computing, Arto Kaarna, Technical Physics, Erkki Lähderanta.

Teaching Methods:

Participation in the work of the research group, 1st-4th period. Total 26-156 h.

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:

Passed/failed. Research report and seminar presentation.

Course Materials:

Scientific articles related to the research topic, agreed with the supervisor of the project.

Prerequisites:

BM10A0500 Research Methods.

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

No

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

No

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: Arto Kaarna, Erkki Lähderanta, 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.

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.

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

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.

BM30A0601: Optoelectronics, 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: Erkki Lähderanta

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Erkki Lähderanta

Aims:

To understand the basics of optical data communication. Construction of wave guides using total internal reflection and working principals of light emitting diodes and photodetectors.

Contents:

Optical waveguides, light emitting devices and photodetectors.

Teaching Methods:

Lectures 35 h, exercises 14 h, preparation for exam 107 h, 1st period. Examination.

Suitability for doctoral studies (Yes/Leave empty):

Yes

Assessment:

0-5, examination 100 %.

Course Materials:

Kasap, S. O.: Optoelectronics and Photonics P. Silfsten & E. Vartiainen: Optoelektroniikka,

Prerequisites:

Physics or Physics L.

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.

MaDMa100: Technomathematics, 70 - 76 cp

Validity: 01.08.2009 -
Form of study: Major studies
Type: Study module
Unit: LUT School of Engineering Science

No course descriptions.

Specialisation studies in Technomathematics consists of obligatory studies (64 ECTS cr) and alternative studies (10 ECTS cr).

BM10A0000: Master's Thesis and Seminar, 30 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: Arto Kaarna

Year:

M.Sc. (Tech.) 2

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

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

Aims:

Student has general knowledge about a specific field of engineering and applied science in modern society and is able to apply scientific knowledge and methods in the field of the study. The student is able to work independently, prepare a research plan, complete the designed reseach, and operate in a disciplined way.

Contents:

The Master’s thesis is the final project of the Master’s degree, which demonstrates the student’s knowledge of a topic of scientific or societal importance. The thesis is a research or an implementation project. A report is prepared following the instructions for the Master’s thesis. The report contains description of the problem and the context, the used methods, describes the actual analysis and actions in the implementation, provides the results and evaluates the outcomes and conclusions.

Teaching Methods:

The student works independently and keeps contact with the supervisor informing and discussing the progress of the work. The thesis work is presented in a seminar with other thesis students and their instructors. The student gives a short presentation on the results of his/her project. The presentations are discussed and reviewed. Research work 300 h, independent study 200 h, report preparation 200 h.

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:

0-5, Master's thesis 100 %.

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

BM20A4000: Case Study Seminar, 5 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: Heikki Haario, Tuomo Kauranne, Virpi Junttila

Note:

Suitable also for doctoral studies.

Year:

M.Sc. (Tech.) 1 or Doctoral studies

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, Ph.D. Tuomo Kauranne, Professor, Ph.D. Heikki Haario

Aims:

The course gives an introduction to independent scientific work by presenting seminar works from different fields of applied mathematics. After the course, the student is able to prepare and give scientific presentations.

Contents:

The course works in a seminar form. Each student receives a project work topic and presents the problem as well as the work plan in the beginning. For example, the topics cover modelling problems from different engineering fields, together with numerical solutions. Solution methods for the project work problems are discussed during the course. At conclusion, the participants present their project works. The project work typically is an introduction to the diploma work topic of the student.

Teaching Methods:

Lectures 42 h, exercises 14 h, homework 38 h, preparation of the presentation 36 h, 1st-4th period. Total 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:

Pass/fail. To pass the course student must attend 7 weeks and present his/her project work.

Prerequisites:

First year university calculus. Recommended BM20A1501 Numeeriset menetelmät I, BM20A1601 Matriisilaskenta, BJ02A2010 Modelling of Unit Operations

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

BM20A6100: Advanced Data Analysis and Machine Learning, 6 cp

Validity: 01.08.2015 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Engineering Science
Grading: Study modules 0-5,P/F
Teachers: Lasse Lensu, Heikki Haario

Year:

M.Sc. (Tech.) 2

Period:

1-2

Teaching Language:

English

Teacher(s) in Charge:

Professor, Ph.D. Heikki Haario

Aims:

The student can pre-process, visualise and analyse multivariate synthetic and real-world data. The student is able to understand and use state-of-the-art regression methods, graphical models and deep learning. The student can use selected methods to solve a practical assignment, analyse the results and report the findings.

Contents:

Characteristics of data sources, and data pre-processing, dimensionality reduction and outlier detection. Principal component and other advanced regression methods. Graphical models and Bayesian networks. Deep learning and convolutional neural networks. Case-based topics on advanced data analysis by visiting lecturers.

Teaching Methods:

Preparation for lectures 7 h, lectures 14 h, preparation for exercise 21 h, exercises 14 h, 1st period. Preparation for lectures 7 h, lectures 14 h, preparation for exercise 21 h, exercises 14 h, practical assignment 36 h, 2nd period. Self-study 5 h. Exam 3 h. Total amount 156 h.

Assessment:

0-5, exam 50 %, exercises 25 %, practical assignment 25 %.

Course Materials:

Lecture notes in Moodle. Other literature will be announced when the course starts.

Prerequisites:

Recommended: BM20A1901 Statistics II, BM20A2701 Numerical Methods II, BM20A3001 Statistical Analysis in Modelling, BM40A0700 Pattern Recognition or equivalent knowledge.

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.

CS38A0020: Optimization 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: Sirkku Parviainen, Pasi Luukka

Year:

M.Sc. 1.

Period:

4

Teaching Language:

English

Teacher(s) in Charge:

Pasi Luukka, D.Sc. (Tech.), Associate Professor
Sirkku Parviainen, Lic.Phil., Lecturer

Aims:

In the end of the course student is expected to be able to
- formulate mathematical models of various optimization problems
- understand the principles of different optimization algorithms for linear, mixed-integer linear, and nonlinear optimization
- use optimization software

Contents:

Formulation of optimization models. Linear programming and mixed-integer linear programming, nonlinear optimization algorithms.
Solving optimization problems using Matlab Optimization Toolbox. Business and industry oriented practical examples, i.e. factory, warehouse, sales allocation models etc.

Teaching Methods:

Lectures 28 h, exercises 28 h, 4th period. Independent study 74 h, practical assignment 30 h. Written examination. Total work load 160 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 %

Course Materials:

Eppen, G.D., Gould, F.J., Schmidt, C.P.: Introductory management science, Prentice-Hall, 1993
Nocedal, J., Wright, S.J.: Numerical optimization, Springer, 2006
Taha, H.A.: Operations Research an introduction, 8th edition, Prentice-Hall, 2007

Prerequisites:

Experience in programming or using mathematical software required.
BM20A4301 Johdatus tekniseen laskentaan or BM20A5001 Principles of Technical Computing

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

Yes, 20

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

Yes, 10

Alternative studies. Choose at least 10 ECTS cr from following studies.

BJ02A2011: Modelling of Unit Operations, 5 cp

Validity: 01.01.2017 -
Form of study: Basic studies
Type: Course
Unit: LUT School of Engineering Science
Grading: Study modules 0-5,P/F
Teachers: Tuomo Kauranne, Dipal Shah

Note:

Replaces the course BJ02A2010 Modelling of Unit Operations, 6 op

Suitable also for doctoral studies

Year:

M.Sc. (Tech.) 1, M.Sc. (Tech.) 2 or Doctoral Studies

Period:

2

Teaching Language:

English

Teacher(s) in Charge:

Associate professor, Ph.D. Tuomo Kauranne

Aims:

After completing the module the student - can describe steady-state and transient unit operations with mathematical models - can validate models and estimate parameters from experimental data - can apply phenomenon based models in process development and design tasks, such as sizing, optimization, and scale-up - can use mathematical and simulation software.

Contents:

Mechanistic mathematical models in research and design. Steady-state and transient models. Models in different stages of process life cycle. Parameter estimation. Simulation. Optimization. Scale-up. Modern modeling and simulation software.

Teaching Methods:

Lectures 24 h, exercises 14 h, 2nd period. Home assignments 70 h, self-study 46 h. Home assignments passed, no exam. Total workload 154 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

Number of mid-term examinations:

0

Assessment:

1-5.

Course Materials:

In Moodle

Prerequisites:

Either the Finnish course Johdatus tekniseen lasekntaan or Principles of Technical Computing, or corresponding skills in MATLAB programming.

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.

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: Arto Kaarna, Erkki Lähderanta, 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.

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.

BM20A4701: Modelling with Partial Differential Equations, 4 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: Tuomo Kauranne

Year:

M.Sc. (Tech.) 1-2 or Doctoral studies

Period:

1-4

Teaching Language:

English

Teacher(s) in Charge:

Associate Professor, Ph.D. Tuomo Kauranne

Aims:

The student is able to formulate PDE-models, knows fundaments of theory, basic model types and most common numerical schemes, and is able to perform numerical solution using mathematical software tools. The student familiar with a number of application areas. He/she is able to analyze PDE models in multiphysical phenomena, examples are acoustics, solidification and free-boundary computations, crystal growth and impedance tomography

Contents:

Introduction to PDE:s, basics of finite element method, multiphysics and modeling, examples.

Teaching Methods:

Supervised self study course: supervision 5 h, self study 55 h, exam and preparation 10 h, 2nd period. Total 70 h. The course is available in Finnish language as web-course http://hlab.ee.tut.fi/mallinnus/kurssit.

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 100 %

Course Materials:

Endre Suli: Lecture notes on finite element methods for partial differential equations, chapters 1-3 and 5.

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.

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.

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: Aleksandr Bibov, Arto Kaarna

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.

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

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

SaSaM101: , 20 cp

Validity: 01.08.2008 -
Form of study:
Type: Study module
Unit: LUT School of Energy Systems
Grading: Study modules 0-5,P/F

No course descriptions.

Vaihtoehtoiset moduulit, valitse yhdestä moduulista opintojaksoja vähintään 20 op. Esitietovaatimuksena Sähkötekniikka sivuopintojen suorittaminen.

SaSoSaMa: Electricity Market, 20 cp

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

No course descriptions.

Valinnainen moduuli, valitse vähintään 20 op opintojaksoja.

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: Christian Breyer, Jarmo Partanen, Satu Viljainen, 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.

BL20A0201: Power Exchange Game for Electricity Markets, 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: Nadezhda Belonogova, Samuli Honkapuro

Year:

M.Sc. (Tech.) 1

Period:

2-3

Teaching Language:

English

Teacher(s) in Charge:

Professor, D.Sc. (Tech.) Samuli Honkapuro, M.Sc. (tech.) Nadezda Belonogova

Aims:

Upon completion of the course the student will be able to: Plan electricity purchase and sale in an economically viable way, recognize the most common risk management instruments and basic mechanisms of demand response in electricity markets, and exploit financial products of the power exchange in risk management and trade electricity in day ahead and intraday markets. These skills will be practised in a power exchange game, after which the student will be able to analyse and interpret the game results.

Contents:

Electricity purchase/sale, OTC markets, physical products on the power exchange (Elspot and Elbas), financial products on the power exchange (DS Futures and Futures), risk management.

Teaching Methods:

Lectures 8 h, weekly game situation practice 40 h, 2nd and 3rd period. Written homework, intermediate report and final report. Total workload 78 h. The lectures focus on the key learning objectives in the topic. Successful completion of the course requires student’s active independent work.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, written report 100 %.

Course Materials:

Lectures, game instructions, websites

Prerequisites:

BL20A0400 Electricity Markets

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

No

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

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

BL20A0400: 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: Jarmo Partanen, Salla Annala

Note:

Suitable also for doctoral studies.

Year:

M.Sc. (Tech) 1

Period:

1

Teaching Language:

Finnish

Teacher(s) in Charge:

professori, TkT Jarmo Partanen

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 and model electricity consumption, 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, 7. conduct the balance settlement, 8. price the products of electricity trade and distribution, 9. describe why and how electricity distribution business is regulated.

Contents:

The development of electricity markets, loads on the electricity network and load forecasts, power exchange, electricity trade, balance management, the fundamentals of pricing and regulation of distribution business.

Teaching Methods:

28 h of lectures, 14 h of tutorials, 1st period. Independent studies. Written examination. Total workload 130 h. The lectures focus on the core learning objectives in the topic. Successful completion of the course requires student’s active independent work.

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 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.

Related to:

to sustainability

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: Tero Kaipia, Lasse Laurila, Antti Kosonen, Tero Ahonen, Jero Ahola

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

SaSoELE: Electronics, 20 cp

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

No course descriptions.

Valinnainen moduuli, valitse vähintään 20 op opintojaksoja.

BL50A0802: Electronic Equipment and Systems Design, 7 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: Mikko Kuisma, Pertti Silventoinen, Tommi Kärkkäinen

Note:

Soveltuu myös tohtoriopintoihin.

Year:

M.Sc. 1

Period:

1-3

Teaching Language:

Finnish

Teacher(s) in Charge:

professori, TkT Pertti Silventoinen

Aims:

Upon completion of the course the student will be able to: 1. write functional and other requirements for an electronic device, 2. apply the knowledge from previous courses to electronics prototype and larger system design, 3. recognise the key differences between prototype design and industrial production design and take these differences into account in equipment design, 4. apply the acquired design skills from circuit level to complete devices and systems. 5.analyse technical conceptions and manufacturability of an electrical device 6. document and present the projects.

Contents:

Prototype design, designing electronics for mass production, specifying large electronic systems. Test planning. Seminar presentations held by students on topics varying from year to year.

Teaching Methods:

7 h of lectures, 1st period. Team meetings and seminar presentations 12 h, 2-3rd period. Assignments and seminar work. Independent study 100 - 160h.

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. Satisfactorily completed assignments and seminar work required.

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

BL50A0900: Analog Signal Processing, 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: Mikko Kuisma

Note:

Soveltuu myös tohtoriopintoihin.

Year:

M.Sc. 1-2

Period:

1-3

Teaching Language:

Finnish

Teacher(s) in Charge:

tutkijaopettaja, TkT Mikko Kuisma

Aims:

Upon completion of the course the student will be able to: 1. carry out a small electronics design and testing project 2. design an analog circuitry, such as a modulator and a filter 3. design and match a line driver for a cable (< 1 GHz), 4. work as a part of an electronics design team in a project.

Contents:

Signal analysis of analog and analog/digital systems. Transmission line theory in practical cabling the use of line driver and termination in applications below 1GHz. Signal integrity. Prototype design and debugging. The course focuses on a customer-oriented design and practical implementation of an electronic system (“Mobile speaker” - portable audio player). During the project work we also train and learn group dynamics and project management.

Teaching Methods:

Lectures, problems and laboratory work 56 h, 1st-3rd period. Project work. Independent study 100 h. 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. Project and documentation, participation in the project, peer and self assessment.

Course Materials:

To be announced in class.

Prerequisites:

BL50A1400 Analog electronics recommended.

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.

BL50A1300: Advanced Course in Electronics, 6 cp

Validity: 01.08.2008 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Pertti Silventoinen, Jero Ahola

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.) Pertti Silventoinen, Professor, D.Sc. (Tech.)Jero Ahola

Aims:

The student prepares a seminar presentation on a new topic in electronics. Upon completion of the course the student will be able to demonstrate in-depth knowledge of a new topic in electronics.

Contents:

The course contents are subject related and will be specified during the introductory lectures.

Teaching Methods:

2 h of introductory lectures, 12 h of seminar presentations, 3rd period. 12 h of seminar presentations, 4th period. No written examination. Independent work 134 h. Total workload 162 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):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, seminar presentation 100 %.

Course Materials:

The material will be specified in the introductory lecture.

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.

BL50A1400: Analog Electronics, 6 cp

Validity: 01.08.2008 -

Form of study: Basic studies

Type: Course

Unit: LUT School of Energy Systems

Grading: Study modules 0-5,P/F

Teachers: Heikki Järvisalo, Pertti Silventoinen

Year:

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

Period:

1-2

Teaching Language:

Finnish

Teacher(s) in Charge:

Professori, TkT Pertti Silventoinen

Aims:

Upon completion of the course the student will be able to: 1. name the most significant components in analog electronics and describe the basic operating principles of the components 2. dimension the biasing circuit of a transistor amplifier 3. analyse the transistor amplifiers using small signal models, 4. recognise and describe the properties of practical operational amplifiers and their effects on amplifier design, 5. perform the thermal dimensioning of a simple electronic circuit.

Contents:

Basic components in analog electronics, diodes, transistors, integrated circuits. Differential and operational amplifiers, multistage amplifiers, power amplifiers, oscillators. Analog special components.

Teaching Methods:

12 h of lectures, 12 h of tutorials, 1st period. 12 h of tutorials, 8 h of laboratory work 8h, 2nd period. Assignment 1st-2nd period. Independent study 112 h. Written examination. Total workload 162 h.

Examination in Examination schedule (Yes/No):

Yes

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

0-5, written examination, tutorials and assignment.

Prerequisites:

BL50A0100 Basic Analog Electronics recommended.

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.

BL50A1600: Electronics, Laboratory Course 2, 3 - 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: Tommi Kärkkäinen

Year:

M.Sc. 1-2

Period:

1-4

Teaching Language:

Finnish

Teacher(s) in Charge:

tutkijaopettaja, TkT Mikko Kuisma

Aims:

Upon completion of the course the student will be able to: 1. apply theoretical studies of other courses to practical electronics design, problem solving and prototype construction, 2. use multimeters, oscilloscopes, signal generators, power supplies and other measuring instruments, 3. analyse the operation of circuits based on measurements, 4. produce a scientific, technical report, 5. act as a team member in an electronics project and bear their responsibility of the success of the project.

Contents:

Electronics laboratory work and prototype testing, the use of measuring instruments. Electronics design, testing, troubleshooting, hand soldering, electronics circuit simulation, project work and project management.

Teaching Methods:

Defining, implementing and documenting an electronics project. Electronics design, laboratory work and reporting, 1st-4th period. Independent study 80-160 h.

Examination in Examination schedule (Yes/No):

No

Examination in Moodle (Yes/No):

No

Examination in Exam (Yes/No):

No

Assessment:

1-5. Assessment based on the produced documentation and the success of the project 80 %, and personal tasks 20 %.

Course Materials:

Moodle material, material announced in class.

Prerequisites:

BL50A0502 Electronics, Laboratory Course 1.

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.

BL50A1700: Electronics project, 2 - 8 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: Mikko Kuisma, Pertti Silventoinen

Note:

Soveltuu myös tohtoriopintoihin.

Year:

M.Sc. 2

Period:

1-4

Teaching Language:

Finnish

Teacher(s) in Charge:

D.Sc. (Tech.) Mikko Kuisma

Aims:

Upon completion of the course the student will be able to: 1. apply the knowledge obtained from electronics courses to practice, 2. design an electronics device or a specified part of an electronics device that meets the given requirements, 3. work in an electronics R&D team, 4. place his/her work into the context of an R&D project, 5. communicate issues related to the project with other project team members.

Contents:

Depends on the yearly project, typically: properties of electronics components, design and thermal design of electronics, measurements and signal processing, embedded system design, implementation, and programming, EMC, applications of power electronics, protection in an electronic device.

Teaching Methods:

Implementation of an electronics device in a project group. Independent study 52-208 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, project work, peer assessment and reporting 100 %.

TuSOYritt: , 20 - 35 cp

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

No course descriptions.

Obligatory

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: Marita Rautiainen, Timo Pihkala

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.

CS34A0732: New Venture Creation, 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: Marita Rautiainen, Timo Pihkala

Year:

M.Sc. (Tech.) 1

Period:

3

Teaching Language:

Finnish

Teacher(s) in Charge:

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

Aims:

The course targets on the entrepreneurial phenomenon and especially on start-up analysis. After the course the student is familiar with entrepreneurship theory that integrates creativity, resource-based characteristics and accounting. In addition, the student will manage the start.-up process, the main calculations prior to the start-up and the preparation of business plan.

Contents:

Entrepreneurship process, start-up theory, start-up strategies, activities in start-up, financial analysis of the business concept, business plan and evaluation criteria

Teaching Methods:

Lectures 20 h. Prior reading 60 h. Written assignment 76 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, evaluation 0-100 points. Assignments 100%.

Course Materials:

1. Wickham, Phillip A.: Strategic entrepreneurship: a decision-making approach to new venture creation and management. London: Pitman Publishing, 1998 tai uudempi. 328 s.
2. McKinsey & Co. (2000). Ideasta kasvuyritykseksi. WSOY. Helsinki. 245 s.
3. Lecture material

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):

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.

Selectable

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.

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: Suvi Konsti-Laakso, Timo Pihkala

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.

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.

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

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

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.

CS34A0351: Entrepreneurial growth and 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

Year:

M.Sc. (Tech.) 1

Period:

1

Teaching Language:

Finnish

Teacher(s) in Charge:

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

Aims:

The students become familiar with the basic concepts of entrepreneurial growth, growth strategies and the latest theoretical directions within entrepreneurship research. After the course, the students are able recognize different forms of growth, growth potential and routes for business development.

Contents:

Models, theories and approaches on entrepreneurial growth, growth strategy and SME development.

Teaching Methods:

Lectures 20 h, 1st period. Prior reading and assignments 106 h, Preparation for lectures, 30 h. In total 156 h.
For doctoral students the teaching methods will be separately considered.

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, Moodle-exams (50%) and written assignment (50%).

Course Materials:

Cases and articles delivered during the course. Lecture materials

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.

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

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: Marita Rautiainen, Timo Pihkala

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: Suvi Konsti-Laakso, Timo Pihkala

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.

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: Jari Porras, Helinä Melkas, Antti Herala, Mirva Hyypiä

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