Opasraportti

Computer Science and Engineering (2014 - 2015)

Tietotalo 1 student affairs office (TS 110 - TS114) is open daily 9.30 - 14.00.

More on studies

Tutkintorakenteet

Degree Programme in Information Engineering, B.Sc.(E)

Tutkintorakenteen tila: published

Lukuvuosi: 2014-15

Lukuvuoden alkamispäivämäärä: 01.08.2014

Basic and Intermediate Studies (130 - 140 op)

A452120: Basic and Intermediate Studies, Information Engineering, 120 - 150 op
  Second domestic language
    901008P: Second Official Language (Swedish), 2 op
    900009P: Second Official Language (Finnish), 2 op
  Compulsory studies
    521005P: Orientation Course for New CSE Students, 1 op
    030005P: Information Skills, 1 op
    902011P: Technical English 3, 6 op
    031010P: Calculus I, 5 op
    031011P: Calculus II, 6 op
    031019P: Matrix Algebra, 3,5 op
    031021P: Probability and Mathematical Statistics, 5 op
    031018P: Complex Analysis, 4 op
    031023P: Mathematical Structures for Computer Science, 5 op
    031050A: Signal Analysis, 4 op
    031017P: Differential Equations, 4 op
    761102P: Basic Thermodynamics, 2 op
    761101P: Basic Mechanics, 4 op
    761103P: Electricity and Magnetism, 4 op
    761104P: Wave Motion, 3 op
    521412A: Digital Techniques 1, 6 op
    521141P: Elementary Programming, 5 op
    521267A: Computer Engineering, 4 op
    521109A: Electrical Measurement Principles, 5 op
    521150A: Introduction to Internet, 5 op
    521142A: Embedded Systems Programming, 5 op
    521457A: Software Engineering, 5 op
    521144A: Algorithms and Data Structures, 6 op

521453A: Operating Systems, 5 op
521275A: Embedded Software Project, 8 op
521361A: Telecommunication Engineering II, 3 op
521145A: Human-Computer Interaction, 5 op
521495A: Artificial Intelligence, 5 op
521337A: Digital Filters, 5 op
521467A: Digital Image Processing, 5 op

Module preparing for the option (10 op)

Information Technology

A452121: Module Preparing for the Option, Information Technology, 10 - 30 op
Compulsory studies
521484S: Statistical Signal Processing, 5 op
031022P: Numerical Analysis, 5 op

Embedded Systems

A452123: Module Preparing for the Option, Embedded Systems, 10 - 30 op
Compulsory studies
521302A: Circuit Theory 1, 5 op
521431A: Principles of Electronics Design, 5 op

Applied computing

A452149: Module Preparing for the Option, Applied computing, 10 - 30 op
Obligatory studies
521151A: Applied Computing Project I, 10 op

BSc thesis and related studies (10 op)

The extent of the BSc thesis is 8 credits.

521032A: Information Engineering Study, 3 - 8 op
900060A: Technical Communication, 2 op

Optional courses to complete the 180 credit degree can be selected e.g. from other engineering branches, natural sciences and business studies. Practical training, 3 credits, can also be included. Each student's optional studies are approved by programme administration. Some recommended courses in the Finnish language study guide.

Supplementary modules

Recommended modules in the Finnish language study guide.

MSc. Engineering, Computer Science and Engineering

Tutkintorakenteen tila: published

Lukuvuosi: 2014-15

Lukuvuoden alkamispäivämäärä: 01.08.2014

Module of the option (60 - 80 op)

Compulsory, choose one of the options. Advanced modules are approximately 30 ects in total.

Information Technology

A452221: Module of the Option, Information Technology, 34 - 35 op
  All compulsory
      031025A: Introduction to Optimization, 5 op
      521466S: Machine Vision, 5 op
      521497S: Pattern Recognition and Neural Networks, 5 op
      521279S: Signal Processing Systems, 5 op
      521259S: Digital Video Processing, 5 op
      521260S: Programmable Web Project, 5 op

Applied computing

A452224: Module of the Option, Applied computing, 35 - 62 op
  Obligatory courses
      521146S: Research Methods in Computer Science, 5 op
      521148S: Ubiquitous Computing Fundamentals, 5 op
      811380A: Basics of Databases, 7 op
      521266S: Distributed Systems, 6 op
      521147S: Mobile and Social Computing, 5 op
      521260S: Programmable Web Project, 5 op
      521479S: Software Project, 7 op

Embedded Systems

A452223: Module of the Option, Embedded Systems, 30,5 - 32 op
  All compulsory
      521404A: Digital Techniques 2, 5 op
      521340S: Communications Networks I, 5 op
      521485S: DSP-laboratory Work, 3,5 op
      521479S: Software Project, 7 op
      521423S: Embedded System Project, 5 op
      521279S: Signal Processing Systems, 5 op

Advanced module (30 - 40 op)

Information technology, advanced module in signal processing

A452271: Advanced Module/Information Technology, Signal Processing (obligatory), 13,5 - 20 op
  Obligatory courses
      521404A: Digital Techniques 2, 5 op
      521321S: Elements of Information Theory and Coding, 5 op
      521280S: DSP Laboratory Work, 5 op
      521146S: Research Methods in Computer Science, 5 op
A452272: Advanced Module/Information Technology, Signal Processing (optional), 15 - 22 op
  Optional courses, module size approx. 35 cr
      521320S: Wireless Communications I, 8 op
      521273S: Biosignal Processing, 5 op
      470444S: Advanced Control Methods, 6 op
      521489S: Research Work on Information Processing, 8 op
      521373S: Communication Signal Processing I, 6 op
      521281S: Application Specific Signal Processors, 5 op
      521493S: Computer Graphics, 7 op
      521445S: Digital Techniques 3, 6 op
      521360S: Communication Signal Processing II, 4 op

Information technology, advanced module in intelligent systems

A452273: Advanced Module/Information Technology, Intelligent Systems (obligatory), 14 - 17 op
  Obligatory courses
      521146S: Research Methods in Computer Science, 5 op
      521493S: Computer Graphics, 7 op

477505S: Fuzzy-neuromethods in Process Automation, 4 op
A452274: Advanced Module/Information Technology, Intelligent Systems (optional), 18 - 25 op
Optional courses, module size apporx. 35 cr
477605S: Digital Control Theory, 4 op
521489S: Research Work on Information Processing, 8 op
521273S: Biosignal Processing, 5 op
470444S: Advanced Control Methods, 6 op
521264S: Human-Computer Interaction Techniques, 5 op
802633S: Statistical Pattern Recognition, 10 op

Information technology, advanced module in Biomedical Information Engineering

A452275: Advanced Module/Information Technology, Biomedical Information Engineering (obligatory), 11 - 20 op
Obligatory courses
521146S: Research Methods in Computer Science, 5 op
521273S: Biosignal Processing, 5 op
521107S: Biomedical Instrumentation, 6 op
A452276: Advanced Module/Information Technology, Biomedical Information Engineering (optional), 20 - 24 op
Optional courses, module size approx. 35 cr
521489S: Research Work on Information Processing, 8 op
080910A: Applied Diagnostic Radiology, 4 op
080901A: Introduction to Technology in Clinical Medicine, 5 op
764638S: Basic Neuroscience, 5 op
753124P: Concepts of genetics, 4 - 7 op
750340A: Basics of bioinformatics, 3 op
764103P: Introduction to biophysics, 2 op

A452286: Advanced module/Applied computing technology (optional), 25 - 40 op
Optional courses, module size approx. 35 credits
521264S: Human-Computer Interaction Techniques, 5 op
812346A: Object Oriented Analysis and Design, 6 op
812347A: Object-Oriented Programming, 6 op
812335A: Interaction Design, 4 op
815653S: Open Source Software Development, 4 op
815309A: Real Time Distributed Software Development, 6 op
817603S: System Design Methods for Information Systems, 5 op
813624S: Information Systems Theory, 7 op
A452285: Advanced module/applied computing technology (obligatory), 10 - 40 op
Obligatory courses
521489S: Research Work on Information Processing, 8 op
521152S: Applied Computing Project II, 10 op

A452287: Advanced module/Applied computing economy (obligatory), 10 - 40 op
Obligatory courses
721412P: Product and Market Strategies, 5 op
721704P: Business Logistics, 5 op
721419P: Consumer Behavior, 5 op
A452288: Advanced module/Applied computing economy (optional), 20 - 40 op
Optional courses, module size approx. 35 credits
806109P: Basic Methods in Statistics I, 9 op
721672S: Economics of Network Industries, 6 op
521489S: Research Work on Information Processing, 8 op
721462S: Business Networks, 6 op
555344S: Management Information Systems, 5 op

A452281: Advanced Module/Embedded Systems, Embedded Systems Electronics (obligatory), 16 - 21 op
Obligatory courses
521281S: Application Specific Signal Processors, 5 op
521306A: Circuit Theory 2, 4 op
521432A: Electronics Design I, 5 op
521445S: Digital Techniques 3, 6 op
A452282: Advanced Module/Embedded Systems, Embedded Systems Electronics (optional), 14 - 39 op
Optional courses, module size approx. 40 cr
521146S: Research Methods in Computer Science, 5 op

521405A: Electronic System Design, 5 op
521320S: Wireless Communications I, 8 op
521443S: Electronics Design II, 5 op
521450S: Optoelectronics, 4 op
521489S: Research Work on Information Processing, 8 op
521484A: Statistical Signal Processing, 5 op
521385S: Mobile Telecommunication Systems, 5 op
521331A: Filters, 4 op
521369A: Simulations and Tools for Telecommunications, 3 op

A452283: Advanced Module/Embedded Systems, Embedded Systems Software (obligatory), 10 - 20 op
A452284: Advanced Module/Embedded Systems, Embedded Systems Software (optional), 23 - 35 op
Optional courses, module size approx. 40 cr
521146S: Research Methods in Computer Science, 5 op
812346A: Object Oriented Analysis and Design, 6 op
812347A: Object-Oriented Programming, 6 op
521320S: Wireless Communications I, 8 op
521489S: Research Work on Information Processing, 8 op
521281S: Application Specific Signal Processors, 5 op
521264S: Human-Computer Interaction Techniques, 5 op
521369A: Simulations and Tools for Telecommunications, 3 op

Supplementary module (15 - 30 op)

Choose optional courses so that your degree is the minimun of 120 cr.

Advanced practical training (3 op)

521013A: Advanced Practical Training, 3 op

Master's Thesis (30 op)

Choose one of the following options:

521981SDI/Information technology; 522984S Information networks; 521984S Embedded systems; 522985S Applied computing

The Master's Thesis requires a written maturity test.

521009S: The Maturity Test for Master`s Degree, 0 op

MSc. Biomedical Engineering

Tutkintorakenteen tila: published

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language and cultural studies (8 op)

900013Y: Beginners' Finnish Course 1, 3 op
900053Y: Beginners' Finnish Course 2, 5 op
900017Y: Survival Finnish, 2 op

Advanced studies (82 op)

521013A: Advanced Practical Training, 3 op
521149S: An introduction to computer vision methods for biomedical images (only for BME-SIP students), 5 - 8 op
764664S: Analysis and simulation of biosystems, 6 op
041201A: Basics in eHealth, 5 op
580402S: Biomedical Imaging Methods, 1 - 5 op
521107S: Biomedical Instrumentation, 6 op
521273S: Biosignal Processing, 5 op
521400S: CSE MasterŽs Thesis Seminar, 1 op
521280S: DSP Laboratory Work, 5 op
521337A: Digital Filters, 5 op
521467A: Digital Image Processing, 5 op
521259S: Digital Video Processing, 5 op
521466S: Machine Vision, 5 op
764634S: Medical physics and imaging, 5 op
521005P: Orientation Course for New CSE Students, 1 op
521497S: Pattern Recognition and Neural Networks, 5 op
521146S: Research Methods in Computer Science, 5 op
521124S: Sensors and Measuring Techniques, 5 op

Master's Thesis (30 op)

The Master's Thesis requires a written maturity test.

522987S: Master's Thesis in Biomedical Engineering, 30 op
521009S: The Maturity Test for Master`s Degree, 0 op

IMP Computer Science and Engineering

Tutkintorakenteen tila: published

Lukuvuosi: 2014-15

Lukuvuoden alkamispäivämäärä: 01.08.2014

Language studies (8 op)

900013Y: Beginners' Finnish Course 1, 3 op
900053Y: Beginners' Finnish Course 2, 5 op
900017Y: Survival Finnish, 2 op

Basic module (19 op)

Mandatory studies.

521013A: Advanced Practical Training, 3 op
521145A: Human-Computer Interaction, 5 op
521005P: Orientation Course for New CSE Students, 1 op
521260S: Programmable Web Project, 5 op
521146S: Research Methods in Computer Science, 5 op

Computer Vision and Signal Processing, advanced module (62 op)

The module consists of 52 ects mandatory courses and the minimum of 10 ects optionals.

521281S: Application Specific Signal Processors, 5 op
521273S: Biosignal Processing, 5 op
521493S: Computer Graphics, 7 op

A452291: Computer Vision and Signal Processing, advanced module, optionals, 10 - 20 op
> *optionals*
>> 521495A: Artificial Intelligence, 5 op
>> 521337A: Digital Filters, 5 op
>> 521484A: Statistical Signal Processing, 5 op
>> 521147S: Mobile and Social Computing, 5 op
>> 521467A: Digital Image Processing, 5 op
>> 521489S: Research Work on Information Processing, 8 op
>> 521148S: Ubiquitous Computing Fundamentals, 5 op

521280S: DSP Laboratory Work, 5 op
521259S: Digital Video Processing, 5 op
521321S: Elements of Information Theory and Coding, 5 op
031025A: Introduction to Optimization, 5 op
521466S: Machine Vision, 5 op
521497S: Pattern Recognition and Neural Networks, 5 op
521279S: Signal Processing Systems, 5 op

Ubiquitous Computing, advanced module (62 op)

40 ects mandatory studies and min. 22 ects optionals.

521151A: Applied Computing Project I, 10 op
521152S: Applied Computing Project II, 10 op
521266S: Distributed Systems, 6 op
812335A: Interaction Design, 4 op
521147S: Mobile and Social Computing, 5 op
521148S: Ubiquitous Computing Fundamentals, 5 op
A452292: Ubiquitous Computing, advanced module, optionals, 17 - 20 op
> *optionals*
>> 521479S: Software Project, 7 op
>> 521264S: Human-Computer Interaction Techniques, 5 op
>> 521149S: An introduction to computer vision methods for biomedical images (only for BME-SIP students), 5 - 8 op
>> 521489S: Research Work on Information Processing, 8 op
>> 521428S: UBI summer school, 5 op
>> 812335A: Interaction Design, 4 op
>> 815653S: Open Source Software Development, 4 op
>> 815309A: Real Time Distributed Software Development, 6 op
>> 817603S: System Design Methods for Information Systems, 5 op
>> 813624S: Information Systems Theory, 7 op
>> 521142A: Embedded Systems Programming, 5 op
>> 521275A: Embedded Software Project, 8 op
>> 521423S: Embedded System Project, 5 op

Master's Thesis (31 op)

Choose one of these: 522986S, computer vision and signal processing; 521910S, Ubiquitous computing

The Master's Thesis requires participation to a seminar and a written maturity test.

521400S: CSE MasterŽs Thesis Seminar, 1 op
521009S: The Maturity Test for Master`s Degree, 0 op

Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

521993S: Master's Thesis in Computer Engineering, 30 op

Opintojaksojen kuvaukset

Tutkintorakenteisiin kuuluvien opintokohteiden kuvaukset

A452120: Basic and Intermediate Studies, Information Engineering, 120 - 150 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Basic and Intermediate Studies
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Second domestic language

901008P: Second Official Language (Swedish), 2 op

Voimassaolo: 01.08.1995 -
Opiskelumuoto: Basic Studies
Laji: Course
Opintokohteen kielet: Swedish
Leikkaavuudet:

ay901008P   Second Official Language (Swedish) (OPEN UNI)   2.0 op

Proficiency level:

B1/B2/C1 (Common European Framework of Reference)

Status:

This course is compulsory to all students except those who have at least 60 ECTS credits of Swedish studies in their degrees. The language proficiency provided by the course unit is equivalent to the language proficiency required of a state official with an academic degree working in a bilingual municipality area (Act 424/03 and Decree 481/03).
According to the requirements of the law, the student must be able to use Swedish both orally and in writing in various professional situations. Achieving this kind of proficiency during a course unit that lasts for only one semester requires that the student has already achieved the necessary starting proficiency level prior to taking the course.

Required proficiency level:

The required starting proficiency level for students of all faculties is a grade of 7 or higher from the Swedish studies at secondary school (B-syllabus) or equivalent knowledge AND a passing grade from the proficiency test held at the beginning of the course unit. Based on this proficiency test the students are directed to brush up on their language skills if it is deemed necessary; mastering basic vocabulary and grammar is a prerequisite to achieving the necessary language proficiency for the various communication situations one faces in professional life.
If a student has not completed Swedish studies (B-language) at secondary school with a grade of 7 or higher, or his/her language skills are otherwise lacking, he/she must achieve the required proficiency level BEFORE taking this compulsory Swedish course.

ECTS Credits:

2 ECTS credits

Language of instruction:

Swedish

Timing:

Students of the School of Architecture: autumn term of 1st year of studies
Studenst of Students of Industrial Engineering and Management : autumn semester of the 2nd year of studies
Students of Process Engineering and Environmental Engineering: autumn or spring semester of the second year of studies
Mechanical Engineering: autumn or spring semester of the third year of studies
The Faculty of Information Technology and Electrical Engineering: Students of Electrical Engineering and Computer Science Engineering: Autumn or spring term of 1st year of studies.

Learning outcomes:

Upon completion of the course unit the student should be able to read and understand texts from his/her academic field and make conclusions based on them. The student should be able to write typical professional emails and short reports. He/she should be able to carry himself/herself according to Swedish etiquette when acting as host or guest. The student should also be able to discuss current events and special field-specific matters, use the vocabulary of education and plan and give short oral presentations relating to his/her own field.

Contents:

Communicative oral and written exercises, which aim to develop the student's Swedish proficiency in areas relevant to his/her academic field and future professional tasks. The student practises oral presentation and pronunciation. Situational exercises done individually and in pairs and groups. Discussions in small groups. Current texts about the student's special field. Written exercises relating to the student's professional field. Practising presentation skills.

Mode of delivery:

Contact teaching

Learning activities and teaching methods:

1 x 90 minutes of contact teaching per week and self-directed study, 53 hours per course.

Target group:

See Timing

Prerequisites and co-requisites:

See Required Proficiency Level

Recommended optional programme components:

-

Recommended or required reading:

Study material will be provided by the teacher.

Assessment methods and criteria:

The course unit focuses on improving both oral and written language skills and requires active attendance and participation in exercises, which also require preparation time. 100% attendance is required. The course unit tests both oral and written language skills.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Oral and written language proficiencies are tested separately and assessed using the so called KORU-criteria (publication of HAMK University of Applied Sciences, 2006). Separate grades will be awarded for the successful completions of both oral and written portions of the course unit: the possible passing grades are **satisfactory skills and good skills** (see language decree 481/03). The grades are based on continuous assessment and testing.

Person responsible:

See contact teachers on the Language and Communication home page http://www.oulu.fi/languagesandcommunication/student_counselling

Working life cooperation:

-

Other information:

Students sign up for teaching in WebOodi. A student can only sign up for one teaching group. When signing up , it is imperative that the student fills in his/her university email address (paju.oulu.fi), major subject and Swedish grades attained during secondary education in the Further Information field. Information in sign-up periods and course unit timetables can be found in WebOodi.

900009P: Second Official Language (Finnish), 2 op

Voimassaolo: 01.08.1995 -
Opiskelumuoto: Basic Studies
Laji: Course
Opintokohteen kielet: Finnish

Proficiency level:

B1/B2/C2

Status:

This course is compulsory to students who received their schooling in Swedish.
The language proficiency provided by the course unit is equivalent to the language proficiency required of a state official with an academic degree working in a bilingual municipality area (Act 424/03 and Decree 481 /03).

Required proficiency level:

Successful completion of the A-syllabus in Finnish (A-finska) during secondary education or equivalent knowledge.

ECTS Credits:

3 credits

Language of instruction:

-

Timing:

Second year of studies

Learning outcomes:

Upon completion of the course the student should have attained the required proficiency level in Finnish to be able to function in his/her studies and professional work tasks. The student should be able to manage in various oral communication situations, read literature from his/her academic field and write fluent texts about his/her special field. The student should also be able to understand standard spoken Finnish as well as Finnish of his/her own special field.
The language proficiency provided by the course unit is equivalent to the language proficiency required of a state official with an academic degree working in a bilingual municipality area (Act 424/03 and Decree 481 /03).

Contents:

Taking the course exam and participating in the teaching, if necessary.

Mode of delivery:

Contact teaching

Learning activities and teaching methods:

The course exam consists of a written section (4 hours) and an oral section (1 hour). 60 hours of contact teaching is arranged for students who fail the exam. Active and regular participation in the teaching is required.

Target group:

Students in the Faculty of Technology who received their schooling in Swedish.

Prerequisites and co-requisites:

Successful completion of the A-syllabus in Finnish (A-finska) during secondary education or equivalent knowledge.

Recommended optional programme components:

-

Recommended or required reading:

To be agreed on.

Assessment methods and criteria:

This course is usually completed by taking the course exam held by the Language Centre. The exam tests the student's Finnish language skills: written and oral text production, reading and listening comprehension and special field-specific language skills. Students who fail the exam may attend Finnish language teaching, after which they must retake and pass the exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Separate grades are given for written and oral language skills: the possible passing grades are satisfactory skills and good skills. Satisfactory skills equal B1 proficiency and good skills equal B2 proficiency or higher in the Common European Framework of Reference for Languages (CEFR).

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

The written exam is held during the autumn semester. Students sign up for the exam in WebOodi. The date of the oral exam is agreed upon separately. Students must bring a copy of their matriculation examination certificate with them when they come to the exam. If they have completed the Central Government's language proficiency exam, they must bring a copy of that certificate with them as well.

Compulsory studies

521005P: Orientation Course for New CSE Students, 1 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

521003P   Orientation Course for International CSE Students   1.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

1

Language of instruction:

Finnish. English when needed.

Timing:

Autumn, periods 1-3.

Learning outcomes:

After completing this course, students are familiar with academic studies and study-related services. Students know how to plan and schedule their studies based on their program curriculum. Students can use the necessary information and computer systems.

Contents:

Issues related to starting the studies. The university, student organizations, social services offered to students (such as financial aid, sports and health services). University of Oulu, Department of Computer Science and Engineering, university administration. Degrees and studies in computer science and engineering, student exchange and PhD studies. Professional profile and current employment situation of the MSc in technology. Study planning and techniques, personal study plan (PSP). Introduction to the

library and data services (Oula database). Department of Computer Science and Engineering website, Noppa, Lukkari and other information systems and tools, introduction to the use of work station.

Mode of delivery:

Fce-to-face teaching.

Learning activities and teaching methods:

Student tutoring, teacher tutoring, laboratory exercises on the use of work station, information sessions offered by the Faculty of Technology and degree program, independent work, total of 30 hours.

Target group:

First year BSc students in computer science and engineering

Prerequisites and co-requisites:

None.

Recommended optional programme components:

-

Recommended or required reading:

Study guidebook, websites

Assessment methods and criteria:

Participation in information sessions as well as student and teacher tutoring. Each student is required to submit a PSP for passing the course.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Pass/fail.

Person responsible:

Programme Director Jukka Riekki.

Working life cooperation:

None.

Other information:

-

030005P: Information Skills, 1 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Faculty of Technology

Arvostelu: 1 - 5, pass, fail

Opettajat: Sassali, Jani Henrik, Koivuniemi, Mirja-Liisa

Opintokohteen kielet: Finnish

Leikkaavuudet:

   030004P   Introduction to Information Retrieval   0.0 op

ECTS Credits:

1 ECTS credit

Language of instruction:

Finnish

Timing:

2nd or 3rd year

Learning outcomes:

Students know the different phases of information retrieval process and basic techniques of scientific information retrieval. They will find the most important reference databases of their discipline and know how to evaluate information sources and retrieval results.

Contents:

Retrieval of scientific information, the retrieval process, key databases of the discipline, and evaluation of information retrieval and information sources.

Mode of delivery:

Blended teaching: classroom training, web-based learning material and exercises in Optima environment, a final assignment on a topic of the student's own choice

Learning activities and teaching methods:

Training sessions 8h, group working 7h, self-study 12h

Target group:

Compulsory for all students of the Faculty of Technology, the Faculty of Information Technology and Electrical Engineering and the Faculty of Architecture. In the Faculty of Science compulsory for students of biology, physics, geosciences, chemistry and geography. Optional for students of biochemistry and mathematics.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Web learning material https://wiki.oulu.fi/display/030005P.

Assessment methods and criteria:

Passing the course requires participation in the training sessions and successful completion of the course assignments.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

pass/fail

Person responsible:

Science and Technology Library Tellus, tellustieto (at) oulu.fi

Working life cooperation:

-

Other information:

-

902011P: Technical English 3, 6 op

Voimassaolo: 01.08.1995 -
Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

Proficiency level:

CEFR B2 - C1

Status:

This course is compulsory for the students who have chosen English as their foreign language. (See the foreign language requirements for your own degree programme.)

Required proficiency level:

English must have been the A1 or A2 language at school or equivalent English skills acquired otherwise. If you need to take English, but lack this background, please get in touch with the Languages and Communication contact teacher for your department to discuss individual solutions.

ECTS Credits:

6 ECTS credits (The workload is 160 hours.)
STUDENTS OF ENGINEERING: The course consists of 3 x 2-ECTS modules.
STUDENTS OF ARCHITECTURE: The course consists of 2 x 3-ECTS modules.

Students with the matriculation exam grade *Laudatur* or *Eximia cum laude approbatur* will be exempted from part of the course (2 ECTS credits).

Language of instruction:

English

Timing:

STUDENTS OF ENGINEERING:
PYO, KO, TuTa: *1st & 2nd* years of studies, beginning 1st year autumn.
SO & CSE: 2nd & 3rd years of studies, beginning 2nd year autumn.
STUDENTS OF ARCHITECTURE:
1st & 2nd years of studies, beginning 1st year spring and continuing 2nd year autumn.

Learning outcomes:

By the end of the course, you will be able to
  • demonstrate efficient strategies and methods for developing and maintaining your English proficiency
  • communicate using the core vocabulary required for professional language use in your field
  • apply language skills, intercultural awareness and presentation techniques necessary for working in a multicultural environment
  • use language, culture and communication skills at a B2-C1 CEFR level in accordance with your own professional needs.

Contents:

In this course, you will focus on developing oral and written English language skills which enable you to follow developments in your own professional field and manage successfully in an international, intercultural working environment.

STUDENTS OF ENGINEERING:
The course consists of three modules:
  1. first, **Professional English for Technology** (PET, 2 ECTS credits),
  2. then **two modules** (2 ECTS credits each) from a free-choice module menu, in which each module has its own content. These modules allow you to develop further skills in specific core areas. Read the module descriptions with care so that you choose modules which match your own needs, interests and level.

     TuTa students, however, take ONE module from the free-choice menu and then, in second year autumn, the Business Plan module, which is integrated with a course in their own department (*555222A Tuotantotalouden harjoitustyöt*) .

STUDENTS OF ARCHITECTURE:
The course consists of two modules:
See the course description of each module (902011P-38 module A and 902011P-39 module B for a detailed explanation of the course content.

Mode of delivery:

STUDENTS OF ENGINEERING: The mode of delivery varies according to the modules you take. See the course descriptions for the individual modules.
STUDENTS OF ARCHITECTURE: face-to-face teaching in the premises of your own department and independent study

Learning activities and teaching methods:

STUDENTS OF ENGINEERING: The teaching methods and learning activities depend on which free-choice modules you choose. See the course descriptions for the individual modules.
STUDENTS OF ARCHITECTURE:
The classroom teaching comprises about 50% of the total student workload for the course and includes mini-lectures, group and teamwork, student presentations. The independent work component comprises online work and independent study in preparation for classroom activities.

Target group:

Students of the Faculty of Technology
- all Engineering Departments
- the Department of Architecture

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Materials will be provided by the teacher.

Assessment methods and criteria:

Assessment methods vary according to the individual modules taken. The assessment criteria are based on the learning outcomes of the module.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

pass / fail.

Person responsible:

Each department in the Technical Faculty has its own Languages and Communication contact teacher for questions about English studies.

Working life cooperation:

-

Other information:

See the Languages and Communication Study Guide, English, TTK.

031010P: Calculus I, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Ilkka Lusikka

Opintokohteen kielet: Finnish

Leikkaavuudet:

   ay031010P   Calculus I (OPEN UNI)   5.0 op

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Autumn semester, periods 1-3.

Learning outcomes:

After completing the course the student identifies concepts of vector algebra and can use vector algebra for solving problems of analytic geometry. The student can also explain basic characteristics of elementary functions and is able to analyse the limit and the continuity of real valued functions of one variable. Furthermore, the student can solve problems associated with differential and integral calculus of real valued functions of one variable.

Contents:

Vector algebra and analytic geometry. Limit, continuity, differential and integral calculus and applications of real valued functions of one variable. Complex numbers.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 55 h / Group work 22 h.

Target group:

-

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Grossmann, S.I.: Calculus of One Variable; Grossmann, S.I.: Multivariable Calculus, Linear Algebra and Differential Equations (partly); Adams, R.A.: A Complete Course Calculus (partly).

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

031011P: Calculus II, 6 op

Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Ilkka Lusikka
Opintokohteen kielet: Finnish
Leikkaavuudet:

031075P   Calculus II   5.0 op
ay031011P   Calculus II (OPEN UNI)   6.0 op

ECTS Credits:

6

Language of instruction:

Finnish

Timing:

Spring semester, periods 4-6.

Learning outcomes:

After completing the course the student is able to examine the convergence of series and power series of real terms and estimate the truncation error. Furthermore, the student can explain the use of power series e.g. in calculating limits and approximations for definite integrals and is able to solve problems related to differential and integral calculus of real and vector valued functions of several variables.

Contents:

Sequences, series and power series of real terms. Differential and integral calculus of real and vector valued functions of several variables.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 62 h / Group work 26 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the course 031010P Calculus I.

Recommended optional programme components:

-

Recommended or required reading:

Kreyszig, E.: Advanced Engineering Mathematics; Grossmann, S.I.: Multivariable Calculus, Linear Algebra and Differential Equations.

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Ilkka Lusikka

Working life cooperation:

-

Other information:

-

031019P: Matrix Algebra, 3,5 op

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Matti Peltola

Opintokohteen kielet: Finnish

Leikkaavuudet:

   031078P   Matrix Algebra   5.0 op

ECTS Credits:

3,5

Language of instruction:

Finnish

Timing:

Autumn semester, periods 1-3

Learning outcomes:

After completing the course the student is able to apply arithmetic operations of matrices. He can solve system of linear equations by matrix methods and can apply iterative methods to find the solution of the system of linear equations. The student is able to recognise the vector space and can relate the consepts of linear transform and matrix. He can analyse matrices by the parameters, vectors and vector spaces of matrices. The student is able to diagonalize matrices and apply diagonalization to the simple applications.

Contents:

Vectors and matrices. Systems of linear equations. Vector spaces and linear transformations. The rank, nullity, row space and the column space of a matrix. The determinant of a matrix. Eigenvalues and eigenvectors of a matrix. The diagonalization with applications. The iterative methods of solving linear system of equations. The theorems of Gershgorin and Cayley- Hamilton.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40 h / Group work 20 h.

Target group:

-

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Grossman, S.I. : Elementary Linear Algebra, David C. Lay: Linear Algebra and Its Applications.

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Matti Peltola

Working life cooperation:

-

Other information:

-

031021P: Probability and Mathematical Statistics, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Jukka Kemppainen

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay031021P   Probability and Mathematical Statistics (OPEN UNI)   5.0 op

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Spring semester, periods 4-6

Learning outcomes:

After completing the course the student knows the key concepts of probability and the most important random variables and is able to use them in calculating probabilities and parameters of probability distributions. In addition, the student is able to analyze statistical data by calculating interval and point estimates for the parameters. The student is also able to formulate statistical hypotheses and test them.

Contents:

The key concepts of probability, random variable, parameters of probability distributions, estimation of parameters, hypothesis testing.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

 Lectures 44 h/Exercises 22 h/Self-study 68 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisites are the course 031010P Calculus I and some parts of the course 031011P Calculus II.

Recommended optional programme components:

-

Recommended or required reading:

Milton, J.S., Arnold, J.C. (1992): Introduction to Probability and Statistics.

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Jukka Kemppainen

Working life cooperation:

-

Other information:

-

031018P: Complex Analysis, 4 op

Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

  031077P   Complex analysis   5.0 op

ECTS Credits:

4

Language of instruction:

Finnish

Timing:

Fall semester, periods 1-2

Learning outcomes:

After completing the course the student is able to calculate the derivative and integral of complex function, is able to calculate contour integrals, understands Cauchy's integral theorem and its consequences, is able to form the series representation of analytic function and use the Residue theory for computing line integrals. Furthermore the student is able to apply complex analysis analysis techniques to simple problems in signal processing.

Contents:

Complex numbers and functions, complex derivative and analyticity, complex series, Cauchy's integral theorem and its consequences, Laurent and Taylor expansions, Residue, the argument principle, Möbiius transformation, applications to signal analysis

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40 h / Group work 20 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the courses Calculus I and II, Differential Equations.

Recommended optional programme components:

Prerequisite to signal Analysis.

Recommended or required reading:

 E.B. Saff and A.D. Saddler, Fundamentals of Complex Analysis with applications to engineering and science.

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Keijo Ruotsalainen

Working life cooperation:

-

Other information:

-

031023P: Mathematical Structures for Computer Science, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Matti Peltola

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay031023P   Mathematical Structures for Computer Science (OPEN UNI)   5.0 op

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Autumn semester, periods 1-3

Learning outcomes:

After completing the course the student is able to apply result of logic to find the truth value of logical statement. He can express sentences of natural language by symbols of logic. He can use arithmetic operations on different number bases. The student is able to apply formal methods of discrete mathematics to model simple information processing problems.

Contents:

Elementary logic. Mathematical induction. Boolean algebra and set theory. Theory of automata and formal languages. Some graph theory.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40 h / Group work 20 h.

Target group:

-

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Rosen K.H.: Discrete Mathematics and Its Applications. Gersting J.L.: Mathematical Structures for Computer Science.

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Matti Peltola

Working life cooperation:

-

Other information:

-

031050A: Signal Analysis, 4 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Kotila, Vesa Iisakki, Pasi Ruotsalainen
Opintokohteen kielet: Finnish
Leikkaavuudet:

   031080A   Signal Analysis   5.0 op

ECTS Credits:

4

Language of instruction:

Finnish

Timing:

3-4

Learning outcomes:

After the course the student is able to calculate the energy, the power, the convolution and the frequency spectrum of discrete and analog, periodic and non-periodic deterministic signals. The student is able to study the stationarity, the ergodicity, the mutual dependence and the frequency content of random signals by means of the auto- and cross-correlation functions, the covariance function and the power- and cross-power spectral densities. The student is able to explain the mathematical grounds of the most central optimal systems used in signal estimation, and can solve related problems.

Contents:

Signals, classification, frequency. Orthogonal expansions. Fourier analysis, analog and digital signal, fast Fourier transform. Random variable. Random signal. Stationarity, ergodicity, autocorrelation. Power spectral density. Autoregressive, Gaussian and Poisson processes. Signal estimation, orthogonality principle, Yule-Walker equations, Wiener filter. Matched filter.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40 h /Group work 20 h. Homework assignments.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the courses 031019P Matrix Algebra, 031021P Probability and Mathematical Statistics, 031018P Complex Analysis.

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes. Proakis, J.G., Manolakis, D.K.: Introduction to Digital Signal Pro-cessing. Shanmugan, K.S., Breipohl, A.M.: Random Signals, Detection, Estimation and Data Analysis.

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Vesa Kotila, Pasi Ruotsalainen

Working life cooperation:

-

Other information:

-

031017P: Differential Equations, 4 op

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Ruotsalainen Keijo

Opintokohteen kielet: Finnish

Leikkaavuudet:

800320A	Differential equations	5.0 op
031076P	Differential Equations	5.0 op

ECTS Credits:

4

Language of instruction:

Finnish

Timing:

Spring, period 4-6

Learning outcomes:

The students can apply differential equations as a mathematical model. They can identify and solve various differential equations and they have knowledge on basic solvability of differential equations. The student can use the Laplace transform as a solution method.

Contents:

Ordinary differential equations of first and higher order. Laplace transform with applications to differential equations.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 44 h / Group work 28 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the course 031010P Calculus I.

Recommended optional programme components:

-

Recommended or required reading:

Kreyszig, E.: Advanced Engineering Mathematics

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Martti hamina

Working life cooperation:

-

Other information:

-

761102P: Basic Thermodynamics, 2 op

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

766348A	Thermophysics	7.0 op
766328A	Thermophysics	6.0 op

ECTS Credits:

2 credits

Language of instruction:

Finnish

Timing:

Every autumn term

Learning outcomes:

The student will learn to recognize and understand ordinary thermodynamic phenomena taking place around us as well as to take them into account and utilize them, for instance, in designing devices and buildings.

Contents:

We cover the basics of temperature, heat and thermal properties of matter both in macroscopic and microscopic levels. Topics in detail: Temperature, thermometers, heat, thermal properties of matter (e.g. thermal expansion, specific heat, phase changes), equations of state, the laws of thermodynamics, heat engines (e.g. internal-combustion engine), refrigerators, the Carnot cycle, entropy.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 16 h, 4 exercises (8 h), self-study 29 h

Target group:

For the students of the University of Oulu

Prerequisites and co-requisites:

No specific prerequisites

Recommended optional programme components:

No alternative course units or course units that should be completed simultaneously

Recommended or required reading:

Young and Freedman; University Physics, Addison Wesley (Edition 10, Chapters 15-18, or Editions 11-13, Chapters 17-20). Similar material can also be found in H. Benson: University physics, Wiley & Sons, New York (Chapters 18-21).
Lecture notes: Basic thermodynamics (in Finnish) by K. Mursula.
Course material availability can be checked here.

Assessment methods and criteria:

2 intermediate examinations (in autumn) or final examination
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Ville-Veikko Telkki

Working life cooperation:

No work placement period

Other information:

https://wiki.oulu.fi/display/761102P/

761101P: Basic Mechanics, 4 op

Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

761118P   Mechanics 1   5.0 op
761118P-01   Mechanics 1, lectures and exam   0.0 op
761118P-02   Mechanics 1, lab. exercises   0.0 op
761111P-01   Basic mechanics, lectures and exam   0.0 op
761111P-02   Basic mechanics, lab. exercises   0.0 op
761111P   Basic mechanics   5.0 op
761101P2   Basic Mechanics   4.0 op

ECTS Credits:

4 credits

Language of instruction:

The lectures will be in Finnish. The textbook is in English and exercises are selected from the textbook. For further information, contact the responsible person of the course.

Timing:

Autumn

Learning outcomes:

The student is able to describe the basic concepts of mechanics and to apply those when solving the problems related to mechanics.

Contents:

We encounter many phenomena related to mechanics in our everyday life. Most engineering sciences are based on mechanics and mechanics forms the basis of many other fields of physics, including modern physics.

Contents in brief: Short summary of vector calculus. Kinematics, projectile motion and circular motion. Newton's laws of motion. Work and different forms of energy. Momentum, impulse and collisions. Rotational motion and moment of inertia. Torque and angular momentum. Rigid body equilibrium problems. Gravitation. Periodic motion. Fluid mechanics.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 32 h, 8 exercises (16 h), self-study 59 h

Target group:

For the students of the University of Oulu

Prerequisites and co-requisites:

Knowledge of vector calculus and basics of differential and integral calculus

Recommended optional programme components:

No alternative course units or course units that should be completed simultaneously

Recommended or required reading:

Text book: H.D. Young and R.A. Freedman: University physics, Addison-Wesley, 13th edition, 2012, chapters 1-14. Also older editions can be used.
Lecture material: Finnish lecture material will be available on the web page of the course.
Course material availability can be checked here.

Assessment methods and criteria:

Four mini examinations and end examination or final examination
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Anita Aikio

Working life cooperation:

No work placement period

Other information:

https://noppa.oulu.fi/noppa/kurssi/761101P/etusivu

761103P: Electricity and Magnetism, 4 op

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

761119P   Electromagnetism 1   5.0 op

761119P-01   Electromagnetism 1, lectures and exam   0.0 op

761119P-02   Electromagnetism 1, lab. exercises   0.0 op

761113P-01   Electricity and magnetism, lectures and exam   0.0 op

761113P-02   Electricity and magnetism, lab. exercises   0.0 op

761113P   Electricity and magnetism   5.0 op

766319A   Electromagnetism   7.0 op

ECTS Credits:

4 credits

Language of instruction:

The lectures will be in Finnish. The textbook is in English and exercises are selected from the textbook. For further information, contact the responsible person of the course.

Timing:

Spring

Learning outcomes:

The student is able to describe the basic concepts of electricity and magnetism and to apply those when solving the problems related to electromagnetism.

Contents:

Electromagnetic interaction is one of the four fundamental interactions in physics and many phenomena like light, radio waves, electric current, magnetism and formation of solid matter are based on electromagnetism. The current technological development is largely based on applications of electromagnetism in energy production and transfer, telecommunications and information technology. Contents in brief: Coulomb's law. Electric field and potential. Gauss's law. Capacitors and dielectrics. Electric current, resistors, electromotive force and DC circuits. Magnetic field, motion of a charged particle in electric and magnetic fields, and applications. Ampère's law and Biot-Savart law. Electromagnetic induction and Faraday's law. Inductance and inductors. R-L-C circuits, alternating current and AC circuits.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 32 h, 6 exercises (12 h), self-study 63 h

Target group:

For the students of the University of Oulu.

Prerequisites and co-requisites:

Knowledge of vector calculus and basics of differential and integral calculus are needed.

Recommended optional programme components:

No alternative course units or course units that should be completed simultaneously

Recommended or required reading:

Text book: H.D. Young and R.A. Freedman: University physics, Addison-Wesley, 13th edition, 2012, chapters 21-31. Also older editions can be used.
Lecture material: Finnish lecture material will be available on the web page of the course.
Course material availability can be checked here.

Assessment methods and criteria:

Four mini examinations and end examination or final examination
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Anita Aikio

Working life cooperation:

No work placement period

Other information:

https://wiki.oulu.fi/display/761103P/

761104P: Wave Motion, 3 op

Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

761310A   Wave motion and optics   5.0 op

761310A-01   Wave motion and optics, lectures and exam   0.0 op

761310A-02   Wave motion and optics, lab. exercises   0.0 op

761114P-01   Wave motion and optics, lectures and exam   0.0 op

761114P-02   Wave motion and optics, lab. exercises   0.0 op

761114P   Wave motion and optics   5.0 op

ECTS Credits:

3 credits

Language of instruction:

Lectures and exercises in Finnish. Material in English.

Timing:

Spring

Learning outcomes:

The student can classify different types of wave motions and can name the characterizing quantities (wavelength, period, wave speed), can apply geometrical optics to simple mirror and lens systems, can explain the meaning of interference and diffraction and their applications, like using interference to determine wavelength of radiation.

Contents:

Basic course on wave motion, and geometric and wave optics.
Wave motion and propagation. Acoustics. Geometric optics: basic principles, mirrors and lenses. Electromagnetic waves. Wave optics: interference, diffraction, and polarization. Optical instruments. Photometry. Laser.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 32 h, exercises 10 h, self-study 38 h

Target group:

The students of the University of Oulu

Prerequisites and co-requisites:

No specific prerequisites

Recommended optional programme components:

No alternative course units or course units that should be completed simultaneously

Recommended or required reading:

Text book: H.D. Young and R.A. Freedman: University physics, Addison-Wesley, 13th edition, 2008. Also earlier editions can be used.
Course material availability can be checked here.

Assessment methods and criteria:

Four mini examinations and one end examination or a final examination
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Saana-Maija Huttula

Working life cooperation:

No work placement period

Other information:

https://noppa.oulu.fi/noppa/kurssi/761104p/etusivu

521412A: Digital Techniques 1, 6 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Antti Mäntyniemi

Opintokohteen kielet: Finnish

Leikkaavuudet:

   521301A   Digital Techniques 1   8.0 op

ECTS Credits:

6

Language of instruction:

In Finnish.

Timing:

Period 1-3

Learning outcomes:

Learning outcomes: After the course, students are able to ably binary number system and Boolean algebra in the form of switching algebra to the design and functional analyze of simple digital circuits. In addition, they are also able to use in their designs graphical symbols specified in the dependency notation standard (SFS4612 ja IEEE/ANSI Std.91-1991) and different descriptions of function and structure of state machines. Based on this knowledge, students are able to implement and analyze digital devices consisting of ordinary simple digital components, especially FPGA circuits. After having assimilated the basic knowledge of digital technique, students are able to understand also the function and structure of micro controllers and micro processors.

Contents:

Principles of digital devices, Boolean algebra, number notations, analyze and synthesis of combinatorial circuits, flip-flops, principles of state machine behavior, CPLD- and FPGA-circuits, physical characteristics of CMOS technology.

Mode of delivery:

Classroom

Learning activities and teaching methods:

Lectures 40h/ exercises 20h (group exercises)

Target group:

1st year students.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Brown, S., Vranesic, Z. Fundamentals of Digital Logic with VHDL Design, McGraw Hill, 2005, materials in Optima.

Assessment methods and criteria:

Compulsory exercises and exam. Recommended by partial exams.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Exercises: pass/fail. Final grading for the exam 1 – 5.

Person responsible:

Antti Mäntyniemi

Working life cooperation:

\-

Other information:

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521141P: Elementary Programming, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Mika Rautiainen

Opintokohteen kielet: Finnish

Leikkaavuudet:

   ay521141P   Elementary Programming (OPEN UNI)   5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5

Language of instruction:

Finnish, the course can be completed in English by answering the lecture questions and doing the programming exercises and the final exercise.

Timing:

Fall, periods 1-3.

Learning outcomes:

Upon completing the required coursework, the student is able to explain the basic programming concepts and structures and to solve problems using these concepts and structures. Moreover, the student is able to implement small programs independently.

Contents:

Basic concepts of programming, basic structures of programming languages, solving problems by programming.

Mode of delivery:

Web-based teaching + face-to-face teaching

Learning activities and teaching methods:

Study materials web. 20 h lectures with intergrated exercises; in addition, appr. 10 h voluntary guided practising, the rest as independent work.

Target group:

1 st year students of computer science and engineering and electrical engineering and other Students of the University of Oulu.

Prerequisites and co-requisites:

None.

Recommended optional programme components:

The course provides a basis for subsequent programming courses.

Recommended or required reading:

Will be announced at the beginning of the course.

Assessment methods and criteria:

Students answer questions after each lecture and do the programming exercises and the final exercise. Assessment is based on these three elements; passing the course requires points from each element. More detailed information on assessment can be found from http://www.oulu.fi/cse/studying/courses. Read more about assessment criteria at the University of Oulu webpage.

Grading:

pass7fail.

Person responsible:

Mika Rautiainen

Working life cooperation:

-

521267A: Computer Engineering, 4 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Teemu Tokola, Juha Röning

Opintokohteen kielet: Finnish

Leikkaavuudet:

   810122P   Computer Architecture   5.0 op

ECTS Credits:

4

Language of instruction:

Finnish.

Timing:

The course unit is held in the spring semester, during periods 4 - 6. It is recommended to complete the course at the beginning of studies.

Learning outcomes:

The aim of the course is to provide basic understanding to the operation of a digital computer, and to provide basic knowledge for programming using a symbolic programming language. After passing the course, student can explain the basic operation principle of a computer, the phases of an instruction execution, and an interrupt mechanism. The student can explain the basic organization of a computer including CPU, ALU, memory, I/O device, bus, and a register. The student can describe some basic operations of a computer using a register transfer language, and explain the role of instruction format as a part of the control logic. The student can perform conversions between number systems such as decimal, binary and hexadecimal systems. The student can use and interpret the basic data representations used in a digital computer such as integers, fixed point numbers, floating point numbers, and ASCII symbols. The student can explain the arithmetic operations performed using two's complement, the basic principles of a RISC architecture, and the connection of these principles to the performance of the computer. The student can explain a typical memory organization and terms like address space, cache memory, and virtual memory. The student can explain the principles of asynchronous communication, and the operation of the assembler. The student can create small programs using an assembly language.

Contents:

Computer organization and architecture, the operation principle of a computer, register transfer language, data types, interrupt, I/O devices, and memory organization. Assembly language and the operation of an assembler.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 30h, exercises 18h, programming exercise 8h, and exam. The rest of the self-study.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

Student must have completed the following courses are completed prior to applying for the course: 521412A Digital Techniques I.

Recommended optional programme components:

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Recommended or required reading:

Mano M., Computer System Architecture. Prentice Hall, Eng-lewood Cliffs, New Jersey 1993.

Patterson D., Hennessy J., Computer Organization and Design. Morgan Kauffman, San Fracisco, CA, 2005.

Assessment methods and criteria:

Exam and programming exercise.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Juha Röning, Teemu Tokola

Working life cooperation:

-

521109A: Electrical Measurement Principles, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Saarela

Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

Lectures are in Finnish. Laboratory exercises and exams can be done in English.

Timing:

Periods 1-3.

Learning outcomes:

Upon completion of the course, students are be able to measure basic measurements with a ammeter, voltmeter and oscilloscope. They can operate signal and function generators. They can estimate the validity of their measurements.

Contents:

Units of measures, standards of measures, analysis of errors, most commonly used analog and digital measuring methods, equipment and safety regulations.

Mode of delivery:

Pure face-to-face teaching.

Learning activities and teaching methods:

Lectures 20h and laboratory exercises 16 h, independent work 100 h.

Target group:

Course is compulsory for electrical engineering, information engineering and wellness technology students.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Ask the person responsible for English material. (Lectures are based on some chapters of book: W.D. Cooper: Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall, 1990. English labwork material is available.

Assessment methods and criteria:

Exam and passed lab exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Grade is based on exam and grade is on numerical scale 1-5.

Person responsible:

Juha Saarela

Working life cooperation:

-

Other information:

-

521150A: Introduction to Internet, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Electrical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ojala, Timo Kullervo
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

All materials are in English, lectures are given in Finnish.

Timing:

Spring, periods 4-5.

Learning outcomes:

Upon completing the course the student is able to explain the structure of the public Internet and the TCP/IP protocol stack, solve simple Internet problems, and design and implement a small Internet application.

Contents:

Internet's design principles and architecture, TCP/IP protocol stack, most important access networks, most important Internet applications, basics of Internet security.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 32 h / problem solving exercises 12 h / laboratory exercises 12 h / course work 25 h / self-study 52 h. Problem solving exercises, laboratory exercises and course work are completed as group work.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

None.

Recommended optional programme components:

-

Recommended or required reading:

Will be announced at the beginning of the course.

Assessment methods and criteria:

The course uses continuous assessment so that there are 4 intermediate exams. Alternatively, the course can also be passed with a final exam. The course includes a mandatory course work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course uses numerical grading scale 1-5.

Person responsible:

Professor Timo Ojala.

Working life cooperation:

-

521142A: Embedded Systems Programming, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Riekki, Jukka Pekka

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5

Language of instruction:

Finnish, the course can be completed in English by answering the lecture questions and by doing the laboratory exercise, the programming exercises and the final exercise.

Timing:

Spring, periods 4-6.

Learning outcomes:

Upon completing the required coursework, the student is able to implement small C programs both in Unix environment and for embedded systems with memory-mapped I/O. Moreover, the student is able to recognize how embedded systems programming differs from programming general-purpose computers.

Contents:

Basics of C, bitwise operations, memory management, memory-mapped I/O devices, hardware registers, interrupts, compiling and linking.

Mode of delivery:

Web-based teaching + face-to-face teaching

Learning activities and teaching methods:

20 h lectures, 3 h laboratory exercise; 10-20 h voluntary guided practising, the rest as independent work alone and in the two-person groups.

Target group:

1st year students of computer science and engineering and electrical engineering and other Students of the University of Oulu.

Prerequisites and co-requisites:

The following courses must be completed prior to applying for the course: 521141P Elementary programming.

Recommended optional programme components:

The course "521267A Computer Engineering" is recommended to be completed simultaneously.

Recommended or required reading:

Will be announced at the beginning of the course.

Assessment methods and criteria:

Students answer questions after each lecture, participate the laboratory exercise, and do the programming exercises and the final exercise. Assessment is based on these three elements; passing the course requires points from each element. More detailed information on assessment can be found from http://www. oulu.fi/cse/studying/courses.

Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Jukka Riekki

Working life cooperation:

-

521457A: Software Engineering, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Röning

Opintokohteen kielet: English

Leikkaavuudet:

ay521457A   Software Engineering (OPEN UNI)   5.0 op

ECTS Credits:

5

Language of instruction:

Finnish. Material available in English.

Timing:

Autumn, periods 1-3.

Learning outcomes:

After finishing the course, the student knows the basic concepts of software and real-time systems, the different areas of project management, the phases of software development and the goals and tasks of them, is able to use structural methods for defining systems and knows the principles of object-oriented design and analysis. After the course, the student has basic knowledge of utilizing software tools for structural analysis and design.

Contents:

Problematics of software development and the special features of real-time systems in this regard. Software development is viewed in regard to project management and actual implementation: 1. process models, 2. requirements specification, 3. project management basics: design, metrics, risk management, resource management, follow up, quality control, product control, 5. structural analysis and design, 5. software testing methods and strategies, 6. introduction to object-oriented analysis and design.

Mode of delivery:

Face-to-face.

Learning activities and teaching methods:

The course consists of lectures and a laboratory design exercise. The course is completed by a final exam and a successfully completed exercise. Lectures 30 h, laboratory design (in period 3) 12 h, the rest of the self-study.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

521141P Elementary Programming, 521142A Embedded Systems Programming.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

R.S. Pressman: Software Engineering - A Practitioner's Approach. Sixth Edition. McGraw-Hill 2005, chapters 1-11, 13-14 and 21-27. Older editions (4th and 5th) can also be used as a reference. In this case the lectures are based on chapters 1-20.

Assessment methods and criteria:

Final exam and accepted laboratory exercise.

Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Juha Röning

Working life cooperation:

-

521144A: Algorithms and Data Structures, 6 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Susanna Pirttikangas

Opintokohteen kielet: Finnish

Leikkaavuudet:

811312A   Data Structures and Algorithms   5.0 op

ECTS Credits:

6

Language of instruction:

Finnish. The course can be completed in English by answering the lecture questions and doing the laboratory exercises and the final exercise.

Timing:

Fall, periods 1-3.

Learning outcomes:

Upon completing the required coursework, the student is able to evaluate algorithms and data structures and alternatives for implementing them. Moreover, the student is able to design and implement algorithms and data structures.

Contents:

Data structures, algorithms, complexity.

Mode of delivery:

Web-based teaching and face-to-face teaching.

Learning activities and teaching methods:

20 h lectures; 10 h laboratory exercises; the rest as independent work.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

Required: "521141P Elementary Computing" or a course with similar learning outcomes; recommended: " 031023P Mathematical Structures for Computer Science".

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Will be announced at the beginning of the course.

Assessment methods and criteria:

Students answer questions after each lecture and do the laboratory exercises and the final exercise. Assessment is based on these three elements; passing the course requires points from each element. More detailed information on assessment can be found from http://www.oulu.fi/cse/studying/courses. Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Susanna Pirttikangas

Working life cooperation:

None.

521453A: Operating Systems, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Röning

Opintokohteen kielet: English

Leikkaavuudet:

ay521453A   Operating Systems (OPEN UNI)   5.0 op

ECTS Credits:

5

Language of instruction:

In Finnish, material available in English

Timing:

Spirng, periods 5-6

Learning outcomes:

After the course the student is capable of explaining the basic structure and functioning of operating system. He/She is able to point the problems related to process management and synchronization as well as is able to apply learned methods to solve basic problems. Student is capable of explaining the cause and effect related to deadlocks and is able to analyse them related to common circumstances in operating systems. Additionally, the student is able to explain the basics of memory management, the use of virtual memory in modern operating systems as well as the structure of the most common file-systems.

Contents:

Topics: operating system structure and services, process management, process synchronization, deadlocks, memory management, virtual memory, file-systems.

Mode of delivery:

Face-to-face.

Learning activities and teaching methods:

Lectures 30 h, laboratory exercise 6 h, the rest as independent work.

The course consists of lectures and laboratory work, which includes pre-exercise and guided exercise performed in a group of one or two students in the unix environment.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

521141P Elementary Programming, 521142A Embedded Systems Programming, 521267A Computer Engineering

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Lecture notes (in Finnish) and exercise material. Silberschatz A., Galvin P., and Gagne G.: Operating System Concepts, 6th edition (or newer), John Wiley & Sons, Inc., 2003. Chapters 1-12.

Assessment methods and criteria:

The course is passed the final examination and accepted laboratory working.

Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Juha Röning

Working life cooperation:

-

521275A: Embedded Software Project, 8 op

Voimassaolo: 01.08.2007 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Teemu Tokola, Juha Röning
Opintokohteen kielet: English

ECTS Credits:

8

Language of instruction:

Material of the course is available in English, lecturing is given in English.

Timing:

Spirng, periods 4-6.

Learning outcomes:

Embedded software project is the final course in the Bachelor's degree. The skills to pass this course have been acquired in precious courses. During the course, students work in groups to implement a program into an embedded system and write a technical report of the work. The subject of the program is not necessarily covered in previous courses.
After completing the course work, students have demonstrated that they can employ their skills in acquiring information to find a feasible solution to a given problem while still addressing the constraints imposed by a given embedded system. The student has shown that they are capable of designing and then implementing the non-trivial solution as a program to the given embedded system. Furthermore, they have demonstrated that they are capable of writing good-quality scientific text, including a literature survey, theory, technical documentation, testing documentation and other necessary chapters.

Contents:

This course famExilairizes the student with modern embedded system development with modern methods and tools. Topics: Development tools, practical application program for an embedded system.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Pair project with monitoring meetings and a compulsory exercise. Lectures 30 h, design exercise in period 4-6 180 h.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

521457A Software Engineering, 521142A Embedded Systems Programming. In addition, 521453A Operating Systems be beneficial.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Data periodicals, handouts, handbooks

Assessment methods and criteria:

Project report.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Juha Röning, Teemu Tokola

Working life cooperation:

None.

521361A: Telecommunication Engineering II, 3 op

Voimassaolo: 01.08.1950 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kari Heikki Antero Kärkkäinen

Opintokohteen kielet: Finnish

Leikkaavuudet:

521330A   Telecommunication Engineering   5.0 op

ECTS Credits:

3

Language of instruction:

Finnish

Timing:

Fall, periods 2-3

Learning outcomes:

After completing the course student can tell and analyze the essential and optional blocks of a digital communication system both in time and in frequency domain. Student also understands limitations resulting from transmission channel and can propose various methods to combat such effects. Using simple assumptions, student can analyze system performance mathematically and compare various modulation methods from the standpoint point of system resources. Student can evaluate standards and specifications of communication systems. Student can also apply obtained knowledge for practical system and sub-system design.

Contents:

Basic blocks of a digital transmission system, baseband digital transmission, binary and M-ary digital continuous-wave modulations, correlation and matched filter receivers and their bit error probability performance with AWGN channel, effects of band-limiting and multipath propagation and methods to combat against such effects, basics of information theory, basics of source coding and error-correction coding methods.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 28 h and exercises 10

Target group:

3 rd year bachelor's degree students

Prerequisites and co-requisites:

Signal Analysis

Recommended optional programme components:

-

Recommended or required reading:

Lecture slides available in Finnish from TTK-OPTIMA system. Slides are based on the coursebook: R.E. Ziemer & W. H. Tranter: Principles of Communications - Systems, Modulation and Noise, 6th edition, 2010, John Wiley & Sons, selected parts of chapters 8, 9, 10, and 11.

Assessment methods and criteria:

The course is passed with a final examination.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5.

Person responsible:

Kari Kärkkäinen

Working life cooperation:

-

Other information:

-

521145A: Human-Computer Interaction, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Timing:

Autumn, periods 2-3

Learning outcomes:

Upon completing the course the student is able to explain the Human Computer Interaction (HCI) fundamentals, explain evaluation and prototyping techniques, explain how HCI can be incorporated in the software development process.

Contents:

Human and computer fundamentals, design and prototyping, evaluation techniques, data collection and analysis.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures (20 h), exercises (20 h), and practical work (95 h). The course is passed with an approved practical work. The implementation is fully English.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

None. No prior courses are required.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete three group-based activities throughout the semester: design & prototyping (40%), conduct an evaluation (40%), and complete a report of the activities (20%). Passing criteria: all 3 elements (designs, evaluation, report) must be completed, each receiving more than 50% of the available points.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Vassilis Kostakos

521495A: Artificial Intelligence, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pietikäinen, Matti

Opintokohteen kielet: English

Leikkaavuudet:

   ay521495A   Artificial Intellig (OPEN UNI)   5.0 op

ECTS Credits:

5

Language of instruction:

In Finnish. The exam and coursework can be passed in English.

Timing:

Periods 4-5.

Learning outcomes:

After taking the course, the student is able to identify the types of problems that can be solved using methods of artificial intelligence. The student knows the basic concepts of intelligent agents, the common search methods used in artificial intelligence, logic based reasoning and applying planning techniques to problems of artificial intelligence. The student can also apply simple methods to reasoning under uncertainty and machine learning from observation. In addition the student will be able to implement the most common search methods.

Contents:

1. Introduction, 2. Intelligent agents, 3. Solving problems by searching, 4. Informed search and exploration, 5. Constraint satisfaction problems, 6. Games, 7. Logical agents, 8. First-order logic, 9. Inference in first-order logic, 10. Planning, 11. Uncertainty, 12. Bayesian Networks, 13. Learning from observation.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

25 hours of lectures and a programming exercise (approximately 25 hours) during periods 4-5, the rest as independent work.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

Programming skills.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Primary text book and slides (in English): Russel S., Norvig P.: Artificial Intelligence, A Modern Approach (AIMA), Second Edition, Prentice Hall, 2003. Lecture notes (in Finnish): Syrjänen, M.: Tietämystekniikan peruskurssin luentomoniste, Teknillinen korkeakoulu, 2004. More details on the course WWW page http://www.ee.oulu.fi/research/imag/courses/ai/.

Assessment methods and criteria:

The course is passed with a final exam and a passed programming exercise.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5 / fail.

Person responsible:

Professor Matti Pietikäinen, 2013 Esa Rahtu.

Working life cooperation:

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521337A: Digital Filters, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannuksela, Jari Samuli

Opintokohteen kielet: Finnish

Leikkaavuudet:

   ay521337A   Digital Filters (OPEN UNI)   5.0 op

ECTS Credits:

5

Language of instruction:

Finnish, English study material available

Timing:

Spring, period 5-6.

Learning outcomes:

Upon completing the required coursework, the student is able to specify and design respective frequency selective FIR and IIR filters using the most common methods. He is also able to solve for the impulse and frequency responses of FIR and IIR filters given as difference equations, transfer functions, or realization diagrams, and can present analyses of the aliasing and imaging effects based on the responses of the filters. Moreover, the student is able to explain the impacts of finite word length in filter design. After the course the student has the necessary basic skills to use signal processing tools available in Matlab environment and to judge the results.

Contents:

1. Sampling theorem, aliasing and imaging, 2. Discrete Fourier transform, 3. Z-transform and frequency response, 4. Correlation and convolution, 5. Digital filter design, 6. FIR filter design and realizations, 7. IIR filter design and realizations, 8. Finite word length effects and analysis, 9. Multi-rate signal processing.

Mode of delivery:

Face-to-face teaching (Lectures), independent work, group work

Learning activities and teaching methods:

Lectures and exercises 50 h. The design exercises familiarize the students with the methods of digital signal processing using the Matlab software package. The rest as independent work.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

031018P Complex Analysis, 031050A Signal Analysis

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Lecture notes and exercise materials. Material is in Finnish and in English. Course book: Ifeachor, E., Jervis, B.: Digital Signal Processing, A Practical Approach, Second Edition, Prentice Hall, 2002.

Assessment methods and criteria:

The course can be passed either with week exams or a final exam. In addition, the exercises need to be returned and accepted.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Jari Hannuksela

Working life cooperation:

None.

521467A: Digital Image Processing, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Pietikäinen, Matti
Opintokohteen kielet: Finnish
Leikkaavuudet:

    ay521467A   Digital Image Processing (OPEN UNI)   5.0 op

ECTS Credits:

5

Language of instruction:

Lectures in Finnish and exercises in English. Course can be passed in Finnish and English.

Timing:

Autumn, periods 1-3.

Learning outcomes:

After completing the course the student understands the basic theory of digital image processing and knows its main applications. He is able to apply spatial and frequency domain and wavelet based methods in image enhancement, restoration, compression, segmentation and recognition.

Contents:

This course provides an introduction to digital image processing and machine vision. Topics: 1.Introduction, 2.Image enhancement, 3.Image restoration,
4. Color image processing, 5. Wavelets, 6. Image compression,7. Morphological image processing, 8. Image segmentation, 9. Representations and descriptions, 10. Pattern recognition.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 25 h, exercises 7 h and Matlab design exercises 25 h. The rest as independent work.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

None.

Recommended optional programme components:

In order to obtain deep understanding of the content, it is a benefit if the student has completed the first year mathematic courses in the computer science and engineering BSc program or otherwise has equivalent knowledge.

Recommended or required reading:

Gonzalez, R.C., Woods, R.E.: Digital Image Processing, Second Edition, Addison-Wesley, 2002 (see course website: http://www.ee.oulu.fi/research/imag/courses/dkk/). Lecture notes and exercise material.

Assessment methods and criteria:

The course is passed by a final exam and programming exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Matti Pietikäinen

Working life cooperation:

None.

A452121: Module Preparing for the Option, Information Technology, 10 - 30 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Module Preparing for the Option
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory studies

521484S: Statistical Signal Processing, 5 op

Voimassaolo: - 31.07.2012

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Heikkilä, Janne Tapani

Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

In Finnish.

Timing:

Periods 4-6.

Learning outcomes:

Upon completion of the course, the student is able to utilize the generic linear model as a representation for parameter estimation. He can apply typical deterministic and random parameter estimation methods for different estimation problems. He is able to determine statistical properties of estimators and make comparisons between them. The student can also form a basic state-variable model and utilize Kalman filtering for state estimation. Moreover, he is able to apply basic methods of detection theory for solving simple detection problems. After the course, the student can implement the learned methods and assess their statistical properties with the Matlab software.

Contents:

1. Introduction, 2. Modeling of estimation problems, 3. Least Squares estimation, 4. BLUE-estimation, 5. Signal detection, 6. ML estimation, 7. MS estimation, 8. MAP estimation, 9. Kalman Filter.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures (30 h), exercises (24 h) and Matlab design exercise (10 h).

Target group:

-

Prerequisites and co-requisites:

Matrix Algebra, Probability and Mathematical Statistics

Recommended optional programme components:

Digital Filters, Signal Analysis

Recommended or required reading:

J. Mendel: Lectures in estimation theory for signal processing, communications and control, Prentice-Hall, 1995. M.D. Srinath, P.K. Rajasekaran, R. Viswanathan: Introduction to Statistical Signal Processing with Applications, Prentice-Hall, 1996, Chapter 3. Lecture notes and exercise material.

Assessment methods and criteria:

The course is passed with intermediate exams or final exam and accepted Matlab exercise.

Grading:

Numeric scale 1-5

Person responsible:

Janne Heikkilä

Working life cooperation:

-

Other information:

-

031022P: Numerical Analysis, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Marko Huhtanen

Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

Finnish

Timing:

Spring semester, periods 4-5

Learning outcomes:

The student recognizes what numerical solution methods can be used to solve some spesific mathematical problems, can perform the required steps in the numerical algorithm and is able to perform the error analysis.

Contents:

Numerical linear algebra. Numerical methods for systems of equations, Basics of the approximation theory. Numerical quadratures. Numerical methods for ordinary and partial differential equations.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 44 h / Group work 22 h.

Target group:

-

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the courses Calculus I and II, Differential Equations and Matrix algebra.

Recommended optional programme components:

-

Recommended or required reading:

J. Douglas Faires and Richar L. Burden, Numerical methods; Alfio Quarteroni, Riccardo Sacco, Fausto Saleri, Numerical mathematics

Assessment methods and criteria:

Intermediate exams or a final exam.

Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Marko Huhtanen

Working life cooperation:

-

Other information:

-

A452123: Module Preparing for the Option, Embedded Systems, 10 - 30 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Module Preparing for the Option
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Compulsory studies

521302A: Circuit Theory 1, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Electrical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Rahkonen, Timo Erkki
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

Finnish. Exams can be arranged in English on demand.

Timing:

Autumn, periods 1-3

Learning outcomes:

After the course the student can
- write and solve the equations describing the operation of a given electrical circuit
- solve the sinusoidal steady-state solution using complex phasor arithmetics
- solve time responses of electric circuits
- simplify electrical circuits e.g. using equivalent circuits
- simulate simple circuits and choose an appropriate circuit simulation method

Contents:

Equation of basic circuit elements, circuit laws and systematic building of network equations. Calculation of time and frequency responses. Use of complex phasor arithmetics. Basics of the use of circuit simulators.

Mode of delivery:

 Classroom.

Learning activities and teaching methods:

30h lectures, 22 h exercises, and a simulation exercise (10h)

Target group:

Finnish BSc students.

Prerequisites and co-requisites:

Matrix algebra, complex arithmetics, differential equations.

Recommended optional programme components:

-

Recommended or required reading:

Nilsson, Riedel: Electric Circuits (6th or 7th ed., Prentice-Hall 1996), Chapters 1-11.

Assessment methods and criteria:

Final exam. Also the simulation exercise must be passed.
Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

1-5

Person responsible:

Prof. Timo Rahkonen

Working life cooperation:

-

Other information:

-

521431A: Principles of Electronics Design, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Häkkinen

Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

Finnish.

Timing:

Spring, periods 4-6

Learning outcomes:

On completion of the study module students should be able to analyze and design such electronic building blocks as rectifiers, clamping circuits, amplifiers and CMOS logic elements using diodes, operational amplifiers and MOS and bipolar junction transistors.

Contents:

Analogue and digital circuits, basic amplifier related concepts, operational amplifier, diodes and diode circuits, single stage bipolar and MOS transistor amplifiers, small signal modeling and analyzing ac properties of amplifiers, internal structures of digital circuits (mainly CMOS), MOS/CMOS switch.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h and exercises 20 h.

Target group:

-

Prerequisites and co-requisites:

Circuit Theory I

Recommended optional programme components:

 Recommended course Principles of Semiconductor Devices

Recommended or required reading:

Lecture notes, Razavi: Fundamentals of Microelectronics (John Wiley & Sons 2008), chapters 1-8 and 15 partially or Sedra & Smith : Microelectronic Circuits (6th ed.), chapters 1-5 and 14.

Assessment methods and criteria:

Final or 2 mid-term exams.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Juha Häkkinen

Working life cooperation:

-

Other information:

-

A452149: Module Preparing for the Option, Applied computing, 10 - 30 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Module Preparing for the Option
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory studies

521151A: Applied Computing Project I, 10 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Vasileios Kostakos, Ojala, Timo Kullervo
Opintokohteen kielet: English
Leikkaavuudet:

521041A   Applied Computing Project I   8.0 op

Language of instruction:

In English.

Timing:

Autumn and spring, periods 1-6.

Learning outcomes:

Upon completing the course the student is able to complete a full cycle of interactive systems development, including requirements elicitation, system design, prototyping, testing, and evaluation. In this work, the student is able apply skills obtained in B.Sc. courses.

Contents:

Project work.

Mode of delivery:

Face to face teaching, project work as collaborative team work.

Learning activities and teaching methods:

Practical work in project teams. The course is passed with an approved project work. The implementation is fully English.

Target group:

3rd year Computer Science and Engineering B.Sc. students and other Students of the University of Oulu.

Prerequisites and co-requisites:

No prior courses are required.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Dix, Finlay, Abowd & Beale: Human-Computer Interaction (http://www.hcibook.com); Rogers, Sharp & Preece: Interaction Design: Beyond Human-Computer Interaction (http://www.id-book.com).

Assessment methods and criteria:

The course uses continuous assessment so that the project work is assessed in stages: design (20% of total grade), implementation (40%), evaluation (20%), and final report (20%). Passing criteria: all stages (design, implementation, evaluation, report) must be completed with an approved grade.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Vassilis Kostakos, Timo Ojala.

521032A: Information Engineering Study, 3 - 8 op

Voimassaolo: 01.08.2008 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
3-8
Language of instruction:
Finnish/English
Timing:
1-6
Learning outcomes:
In this course the student learns basic research skills by writing a thesis that fulfills the principles scientific reporting. Another objective is to provide deeper knowledge on the given subject area.
  Learning outcomes: After the course the student has rudimentary skills for doing a literature study and using it to write a short thesis that fulfills the principles of scientific writing. He can explain the most essential related methods, and he can utilize the terminology of the given subject in written and oral communications. The student is able to tell about good research practices and use them when working in research oriented tasks.
Contents:
The student makes himself familiar with the problems, concepts and methods of the subject area using scientific literature. He may also implement the selected methods and produce own experimental data. The material obtained is then analyzed and represented as a written thesis that follows the guidelines of the diploma thesis when applicable. Special attention is paid to coverage, consistency and clarity of the presentation.
Mode of delivery:
Independent work
Learning activities and teaching methods:
The subject is selected together with the supervisor. The course includes self-studying and meetings with the supervisor. The thesis can be made also in groups of two students provided that the individual part each student is sufficient and the roles have been clearly specified in the thesis submitted for review. Completing the course requires that the thesis has been accepted.
Target group:
BSc degree students
Prerequisites and co-requisites:
Basic mathematics and related intermediate courses.
Recommended optional programme components:
-
Recommended or required reading:
The material is determined based on the subject.

Assessment methods and criteria:
Written thesis.
Grading:
As BSc thesis pass/fail; as regular course work 1-5.
Person responsible:
Several.
Working life cooperation:
-
Other information:
-

900060A: Technical Communication, 2 op

Voimassaolo: 01.08.2005 - 31.07.2021

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900060A   Technical Communication (OPEN UNI)   2.0 op

470218P   Written and Oral Communication   3.0 op

Proficiency level:
-
Status:
This course unit is compulsory for students of Electrical Engineering, Computer Science, Communications Technologies and Engineering Mechanical Engineering, Process and Environmental Engineering.
Required proficiency level:
-
ECTS Credits:
2 credits
Language of instruction:
Finnish
Timing:
Electrical Engineering, Computer Science and Engineering and Communications Technologies: 2nd year spring term or 3rd year autumn term or 3rd year spring term.
Mechanical Engineering: 3rd year.
Process and Environmental Engineering: 1 st year spring or autumn term.
Learning outcomes:
Upon completion of the course the student should be familiar with the central principles of work and study-related communication, both oral and written, and be able to apply this knowledge in his/her own communication. The student should be able to prepare and give an illustrative and understandable oral presentation on a topic related to his/her own field in a way that suits the audience and the situation. The student should also be able to seek information and report on his/her findings in writing. The student should be able to analyse and assess his/her own writing and the writing of his/her peers. He/she should be able to act in group communication situations in a target-oriented manner. The student should also be able to give and receive constructive criticism.
Contents:
Professional communication skills: team writing, the process of writing and its different stages, distinctive features of formal scientific and professional texts, oral communication, preparing an illustrative presentation, methods of convincing one's audience, giving and receiving constructive criticism, the features of a functioning team, the group process and the roles of team members, negotiations and meeting practices.
Mode of delivery:
Multimodal teaching
Learning activities and teaching methods:
Contact hours ca. 20 h and independent group work or self-study ca. 40 h.
Target group:
Bachelors students of Electrical Engineering, Computer Science, Communications Technologies and Engineering Mechanical Engineering, Process and Environmental Engineering.
Prerequisites and co-requisites:
-
Recommended optional programme components:

-

Recommended or required reading:

Kauppinen, Anneli & Nummi, Jyrki & Savola, Tea: Tekniikan viestintä: kirjoittamisen ja puhumisen käsikirja (EDITA); Nykänen, Olli: Toimivaa tekstiä: Opas tekniikasta kirjoittaville (TEK) and material in Optima study environment.

Assessment methods and criteria:

Active participation in contact teaching, independent study and completion of given assignments.

Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

Pass / fail

Person responsible:

Kaija Oikarainen

Toropainen, Outi

Working life cooperation:

-

Other information:

All students are required to attend the first meeting of the course unit so the work groups can be formed and work started in a timely and efficient manner. When signing up for the course unit, you should keep in mind that completing it requires a responsible attitude and a strong commitment to the work because the teamwork-based exercises rely heavily on the participation and activity of the students.

If the student is involved in the University's student associations or functions in a position of trust in university government, student union administration or Oulun Teekkariyhdistys ry (or in its subordinate guilds), he/she may be relieved of some of the group communication exercises. These compensatory actions must always be agreed upon separately with the course unit's teacher. The student must present an official statement from a person in charge of the governing body or association, which details the student's tasks and involvement with that body or association. Participation that took place over five years ago does not entitle the student to any compensation.

A452221: Module of the Option, Information Technology, 34 - 35 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Module of the Option

Laji: Study module

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

All compulsory

031025A: Introduction to Optimization, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Ruotsalainen Keijo

Opintokohteen kielet: English

ECTS Credits:

5

Language of instruction:

English

Timing:

Fall semester, periods 1-2

Learning outcomes:

After completing the course the student is able to solve optimization convex optimization problems with the basic optimization algorithms. The student is also able to form the necessary and sufficient conditions for the optimality.

Contents:

Linear optimization, Simplex-algorithm, nonlinear optimization, KKT-conditions, duality, conjugate gradient method, penalty and barrier function methods.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40 h / Group work 20 h.

Target group:

Students in Wireless Communication Engineering

Prerequisites and co-requisites:

The recommended prerequisite is the completion of the courses Calculus I and II, Matrix algebra

Recommended optional programme components:

-

Recommended or required reading:

P. Ciarlet; Introduction to numerical linear algebra and optimization, M. Bazaraa, H. Sherali, C.M. Shetty; Nonlinear programming

Assessment methods and criteria:

Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Keijo Ruotsalainen

Working life cooperation:

-

Other information:

-

521466S: Machine Vision, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Heikkilä, Janne Tapani
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

In Finnish.

Timing:

Spring, periods 5-6.

Learning outcomes:

Upon completion of the course, the student can utilize common machine vision methods for various image analysis problems. He is able to carry out region segmentation and pattern recognition using color, texture and shape descriptors computed from images. He can use motion information in image analysis and model matching in image registration and object recognition. The student can explain the basics of geometric computer vision and is able to calibrate cameras as well as to obtain 3D coordinate measurements from the scene using for example stereo imaging. After the course the student has the rudimentary skills to use the Matlab environment and its tools for implementing machine vision methods and analyzing the results.

Contents:

1. Introduction, 2. Imaging and image representation, 3. Binary image analysis, 4. Pattern recognition concepts, 5. Color and shading, 6. Texture, 7. Content-based image retrieval, 8. Motion from 2D image sequences, 9. Image segmentation, 10. Matching in 2D, 11. Perceiving 3D from 2D images, 12. 3D models and matching.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures (30 h), exercises (15 h) and Matlab design exercise (10 h). The rest as independent work.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

521467A Digital Image Processing.

Recommended optional programme components:

521497S Pattern Recognition and Neural Networks. This course provides complementary information on pattern recognition and classification applied in machine vision. It is recommended to be studied simultaneously.

Recommended or required reading:

Shapiro L.G., Stockham G.C.: Computer vision, Prentice Hall, 2001. Lecture notes, exercise material. All course material is in English.

Assessment methods and criteria:

The course is passed with final exam and accepted Matlab exercise.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Janne Heikkilä

Working life cooperation:

No.

521497S: Pattern Recognition and Neural Networks, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Tapio Seppänen
Opintokohteen kielet: Finnish
Leikkaavuudet:

   521289S   Machine Learning   5.0 op

ECTS Credits:

5

Language of instruction:

Lectures are given in Finnish or in English. Programming exercises and calculation exercises are given in Finnish and English. The examination can be taken in Finnish or English.

Timing:

Spirng, periods 5 and 6.

Learning outcomes:

After completing the course the student can solve basic statistical calculation problems of pattern recognition and design simple optimal classifiers from the basic theory and assess their performance. The student can explain the Bayesian decision theory and apply it to derive minimum error classifiers and minimum cost classifiers. The student can apply the basics of gradient search method to design a linear discriminant function. In addition, (s)he can explain the structure and operating principle of some common neural networks.

Contents:

Introduction. Bayesian decision theory. Discriminant functions. Parametric and non-parametric classification. Feature extraction. Classifier design. Example classifiers. Neural networks like Perceptron and SOM.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Introduction Lecture, Exercises 20 hours (10 times 2 hours), Programming Exercises 16 hours (8 times 2 hours), programming work compulsory, written exam.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

The mathematical studies of the BSc of computer science and engineering or equivalent studies, programming skills.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Duda RO, Hart PE, Stork DG, Pattern classification, John Wiley & Sons Inc., 2nd edition, 2001. Haykin S, Neural networks, MacMillan College Publishing Company, 1994 (or more recent). Handouts.

Assessment methods and criteria:

Programming work and calculation exercises are supervised by assistants who also check that the task assignments are completed properly. The course has a written exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Tapio Seppänen

Working life cooperation:

No.

521279S: Signal Processing Systems, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannuksela, Jari Samuli

Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

English

Timing:

Autumn, periods 1-3.

Learning outcomes:

After the course the student can explain the challenges of signal processing hardware, software, and design methodologies. He is able to transform a digital filter designed with floating point arithmetic into a fixed point precision implementation, optimizing the word lengths to achieve the performance specifications. In addition, the student is able to explain the most important algorithm implementation structures and can identify their usage contexts. After the course the student has rudimentary practical skills in modeling, designing, and judging finite word length signal processing algorithms with Matlab and Simulink software tools.

Contents:

Binary and floating point arithmetic, DSP programming models and co-design, digital signal processors, algorithms and implementations, including CORDIC, transforms (FFT and DCT), multi-rate signal processing, polyphase filters, filter banks, adaptive algorithms and applications. The software environments of the course are Matlab with the Fixed Point Toolbox extension and Simulink with the DSP Blockset extension.

Mode of delivery:

Lectures, independent work, group work.

Learning activities and teaching methods:

The course consists of lectures (30 h) and design exercises (6-12 h). the rest as independent work (33h).

Target group:

Computer Science and Engineering students: This is an advanced-level course intended for masters-level students, especially to those that are specializing into signal processing.
+ other Students of the University of Oulu.

Prerequisites and co-requisites:

521337A Digital Filters, 521267A Computer Engineering

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

 Lecture notes and exercise materials. Material is in English.

Assessment methods and criteria:

Final exam and approved design exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Jari Hannuksela

Working life cooperation:

No.

521259S: Digital Video Processing, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Heikkilä, Janne Tapani
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

Finnish.

Timing:

Autumn, periods 2-3.

Learning outcomes:

In this course students become familiar with basics of video processing and communications. The emphasis is in video representation and coding.
After completing the course the student is able to explain the basic formats and representations of digital video signals. He can analyze the frequency properties of video signals as well as the effects of sampling of multi-dimensional signals, and he can specify digital filters for video sampling rate conversions. He is able to model video content by using simple two- and three-dimensional models, and apply certain well-known methods for video motion estimation. The student can explain the essential parts of the techniques used in video coding and the most important properties of common video coding standards. He can also describe the general principles of scalable video coding and error resilient video coding.

Contents:

1. Video formation, 2. Fourier analysis of video signals, 3. Sampling of multi-dimensional signals, 4. Video sampling rate conversion, 5. Video modeling, 6. Motion estimation, 7. Foundations of video coding, 8. Waveform-based coding, 9. Scalable video coding, 10. Video compression standards, 11. Error control in video communications.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

 Lectures (24 h), exercises (10 h) and Matlab design exercise (10 h). The rest as independent work.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

521467A Digital Image Processing, 521337A Digital Filters.

Recommended optional programme components:

521466S Machine Vision, 521488S Multimedia Systems. These courses provide complementary information on analysis and processing of digital video. The courses are recommended to be studied either in advance or simultaneously.

Recommended or required reading:

Y. Wang, J. Ostermann, Y. Zhang: Video processing and communications, Prentice-Hall, 2002, chapters 1-6, 8, 9, 11, 13, 14. Lecture notes and exercise material. All course material is in English.

Assessment methods and criteria:

The course is passed with final exam and accepted Matlab exercise.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Janne Heikkilä

Working life cooperation:

No.

521260S: Programmable Web Project, 5 op

Voimassaolo: 01.08.2006 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail

Opettajat: Mika Rautiainen

Opintokohteen kielet: English

Leikkaavuudet:

   ay521260S   Programmable Web Project (OPEN UNI)   5.0 op

ECTS Credits:

5

Language of instruction:

In English.

Timing:

Spring, periods 4-6.

Learning outcomes:

Objective: The objective of the course is to supply the student with basic understanding of RESTful Web Services and related technologies.
Learning outcomes: Upon completing the required coursework, the student is able to design and implement different components of a RESTful Web Service including the Web client. The student becomes familiar with basic technologies to store data on the server, serialize data in the Web and to create Web based clients.

Contents:

RESTful Web Services, serialization languages (XML, JSON), data storage, HTML5 and AJAX.

Mode of delivery:

Web-based teaching and face-to-face teaching.

Learning activities and teaching methods:

Lectures 4 h, guided laboratory work 10 h, the rest as self-study and group work. Each group implements programs and writes a report.

Target group:

M.Sc. level students of Computer Science and Engineering; other students of the university of Oulu are accepted if there is space in the classes.

Prerequisites and co-requisites:

Elementary programming.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Will be announced at the first lecture.

Assessment methods and criteria:

This course unit utilizes continuous assessment. The students return each chapter of the project report separately and get from the teachers feedback to each chapter.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Mika Rautiainen

Working life cooperation:

None.

Other information:

This course replaces the course "521260S Representing structured information".

A452224: Module of the Option, Applied computing, 35 - 62 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory courses

521146S: Research Methods in Computer Science, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Vasileios Kostakos
Opintokohteen kielet: English
Leikkaavuudet:

813621S   Research Methods   5.0 op

Timing:
Autumn, periods 2-3.

Learning outcomes:
Upon completing the course the student is able to explain the scientific method, create a research plan, design and conduct experimental studies for computer science, write in academic style, and give presentations.

Contents:
Scientific method, research planning, statistics, research tools, research methods, studying humans, academic writing, presentation skills.

Mode of delivery:
Face to face teaching.

Learning activities and teaching methods:
Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:
Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:
No prior courses are required.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
All necessary material will be provided by the instructor.

Assessment methods and criteria:
The assessment is project-based. Students have to complete four individual activities throughout the semester: develop a research plan (20%), complete statistics tests (20%), generate graphs and figures (20%), conduct a mini experiment (40%). Passing criteria: all four elements (research plan, statistics tests, graphs and figures, mini experiment) must be completed, each receiving more than 50% of the available points.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Vassilis Kostakos

521148S: Ubiquitous Computing Fundamentals, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Language of instruction:

In English.

Timing:

Autumn, periods 2-3.

Learning outcomes:

Upon completing the course the student is able to apply the knowledge and methods provided in the course in the design, implementation and evaluation of ubiquitous computing systems.

Contents:

Ubiquitous computing systems, privacy, field studies, ethnography, interfaces, location, context-aware computing, processing sequential sensor data.

Mode of delivery:

Face-to-face.

Learning activities and teaching methods:

Lectures 18 h, exercises 18 h, project work 50 h, self-study 47 h. Exercises and project work are completed as group work.

Target group:

M.Sc. students (computer science and engineering) and other Students of the University of Oulu.

Prerequisites and co-requisites:

None.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Required literature: John Krumm (editor) Ubiquitous Computing Fundamentals, Chapman & Hall, 2010, ISBN 978-1-4200-9360-5, 328 pages; selected scientific publications.

Assessment methods and criteria:

The course is passed with an approved project work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical scale 1-5; zero stands for a fail.

Person responsible:

Professor Timo Ojala.

Working life cooperation:

None.

811380A: Basics of Databases, 7 op

Opiskelumuoto: Intermediate Studies
Laji: Course

Vastuuyksikkö: Department of Information Processing Science

Arvostelu: 1 - 5, pass, fail

Opettajat: Iisakka, Juha Veikko

Opintokohteen kielet: Finnish

Leikkaavuudet:

811318A   Introduction to Data Management   9.0 op

811318A-02   Introduction to data management, exam   0.0 op

811318A-01   Introduction to data management, exercise work   0.0 op

ECTS Credits:

7 ECTS credits/159 hours of work

Language of instruction:

Finnish. One English exercises group will be organized if at least four students need it.

Timing:

2 nd year, autumn semester, period 2, and spring semester, period 3

Learning outcomes:

After completing the course, students understand what databases are and what their meaning for information systems is. They can model conceptually for database designing purposes, design a high-quality relational database and make queries to it. They have constructed a small database application. They are able to throw simple XML-database with XML Schema definitions, and they know how to use an object-relational database in an object-oriented programme. They understand transactions, schedules of transactions, serialiseability of schedules and recovery choices of schedules. They also know what different SQL Isolation levels means to safety of transactions.

Contents:

Conceptual modelling (ER- and EER-diagrams), relational model (theory, databases, query techniques and normalization), XML-databases, object-relational databases, transactions.

Mode of delivery:

Face-to-face

Learning activities and teaching methods:

Lectures 45h, compulsory exercises 24h and (reading 20h) and assignments 27h. Exams 21h. Self-studying 52h.

Target group:

Prerequisites and co-requisites:

The student knows basics of programming.

Recommended optional programme components:

Recommended or required reading:

Silberschatz, Korth & Sudarshan: Database system concepts. Elmasri & Navathe: Fundamentald of database systems.

Assessment methods and criteria:

The course is divided to six parts. All parts must be passed in a year. Students must show they achieve at least half of required knowledge of each part.

Grading:

1-5

Person responsible:

Juha Iisakka

Working life cooperation:

No

521266S: Distributed Systems, 6 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ojala, Timo Kullervo

Opintokohteen kielet: English

Leikkaavuudet:

   521290S   Distributed Systems   5.0 op

Language of instruction:

In English.

Timing:

Spring, periods 4-5.

Learning outcomes:

Upon completing the course the student is able to explain the key principles of distributed systems, apply them in evaluating the major design paradigms used in implementing distributed systems, solve distributed systems related problems, and design and implement a small distributed system.

Contents:

Architectures, processes, com-munication, naming, synchronization, consistency and replication, fault tolerance, security, distributed object-based systems, distributed file systems, distributed web-based systems, distributed coordination-based systems.

Mode of delivery:

Face-to-face.

Learning activities and teaching methods:

Lectures 30 h, exercises 26 h, project work 50 h, self-study 54 h. Project work is completed as group work.

Target group:

M.Sc. students (computer science and engineering) and other Students of the University of Oulu.

Prerequisites and co-requisites:

None.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Required literature: Andrew S. Tanenbaum and Maarten van Steen, Distributed Systems – Principles and Paradigms, Second Edition, Prentice Hall, 2007, ISBN 978-0132392273, 704 pages.

Assessment methods and criteria:

The course uses continuous assessment so that there are 3 intermediate exams. Alternatively, the course can also be passed with a final exam. The course includes a mandatory project work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical scale 1-5; zero stands for a fail.

Person responsible:

Professor Timo Ojala

Working life cooperation:

None.

521147S: Mobile and Social Computing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

521046A	Mobile Computing	5.0 op
521045S	Mobile Computing	5.0 op

Language of instruction:

In English.

Timing:

Spring, periods 4-5

Learning outcomes:

Upon completing the course the student is able to implement mobile user interfaces, implement online social network applications, explain the fundamental concepts of context awareness and online communities.

Contents:

Mobile interface design and implementation, mobile sensor acquisition, context awareness, social platforms, crowdsourcing, online communities, graph theory.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

No prior courses are required.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete two group-based activities throughout the semester: build a mobile application (50%), build an online social application (50%). Passing criteria: both elements (mobile application, social application) must be completed, each receiving more than 50% of the available points.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

521260S: Programmable Web Project, 5 op

Voimassaolo: 01.08.2006 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Mika Rautiainen

Opintokohteen kielet: English

Leikkaavuudet:

   ay521260S   Programmable Web Project (OPEN UNI)   5.0 op

ECTS Credits:

5

Language of instruction:

In English.

Timing:

Spring, periods 4-6.

Learning outcomes:

Objective: The objective of the course is to supply the student with basic understanding of RESTful Web Services and related technologies.
Learning outcomes: Upon completing the required coursework, the student is able to design and implement different components of a RESTful Web Service including the Web client. The student becomes familiar with basic technologies to store data on the server, serialize data in the Web and to create Web based clients.

Contents:

RESTful Web Services, serialization languages (XML, JSON), data storage, HTML5 and AJAX.

Mode of delivery:

Web-based teaching and face-to-face teaching.

Learning activities and teaching methods:

Lectures 4 h, guided laboratory work 10 h, the rest as self-study and group work. Each group implements programs and writes a report.

Target group:

M.Sc. level students of Computer Science and Engineering; other students of the university of Oulu are accepted if there is space in the classes.

Prerequisites and co-requisites:

Elementary programming.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Will be announced at the first lecture.

Assessment methods and criteria:

This course unit utilizes continuous assessment. The students return each chapter of the project report separately and get from the teachers feedback to each chapter.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Mika Rautiainen

Working life cooperation:

None.

Other information:

This course replaces the course "521260S Representing structured information".

521479S: Software Project, 7 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Röning

Opintokohteen kielet: English

ECTS Credits:

7

Language of instruction:

Finnish/English, material available in English.

Timing:

Spring, periods 4-6.

Learning outcomes:

After completing the course, students have demonstrated their capabilities to design, develop and test real-life software. Further, they have shown their proficiency in professionally documenting their work during the assignment.

Contents:

Phases of software engineering process: requirement gathering, analysis, design, implementation, testing, (maintenance). Project-work, starting a project, project management, working with external parties, project documentation. Project related implementation techniques and tools, software documentation.

Mode of delivery:

Face-to-face and independent studies.

Learning activities and teaching methods:

Working methods: The course is done in groups of 3-4 students. The clients are typically various companies and societies. Project progress is supervised in formal reviews, where the project teams present their work as it reaches the milestones: the software requirement specification, the project plan, the software design specification, an operational prototype demonstration, the test documentation, and finally the functional software demonstration and release. In addition to formal reviews the project work is coordinated with steering group meetings. The work environment and development tools vary between projects. The number of students that can attend the course is limited.
Lectures 10 h, design project in period 4-6 180 h.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

521457A Software Engineering, 521453A Operating Systems, 521141P Elementary Programming, 521142A Embedded Systems Programming and varying project related background reading.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Pressman, R.S.: Software Engineering A Practitioner's Approach, 4th edition, Mc Graw-Hill, 1997; Phillips, D.: The Software Project Manager's Handbook, IEEE Computer Society, 2000; Project documentation; project related manuals and handbooks.

Assessment methods and criteria:

Project work and documentation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Juha Röning

Working life cooperation:

-

A452223: Module of the Option, Embedded Systems, 30,5 - 32 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Module of the Option
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

All compulsory

521404A: Digital Techniques 2, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Electrical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Lahti
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

In Finnish.

Timing:

Period 1-3.

Learning outcomes:

After completing this course the student knows the common architectures of synchronous digital logic circuits, and the building blocks they consist of, and can design digital circuits that realize complex data and signal processing functions.

Contents:

1. Logical and physical properties of digital logic components. 2. Representation of digital designs. 3. Combination logic design. 4. Sequential logic design. 5. Digital artithmetics. 6. Semiconductor memories. 7. Register transfer level architecture design. 8. Register transfer level modeling and synthesis. 9. Timing design. 10. Digital interface design. 11. Design verification.

Mode of delivery:

Classroom

Learning activities and teaching methods:

Lectures 24h/ exercises 30h (group work)/independent work 84h.

Target group:

Finnish BSc students.

Prerequisites and co-requisites:

Digital techniques I.

Recommended optional programme components:

-

Recommended or required reading:

Lecture textbook (in finnish) and literature announced during course.

Assessment methods and criteria:

Final exam or term exams, and a design excercise.

Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

1-5, the grade is the average of the exam and the design exercise.

Person responsible:

Jukka Lahti

Working life cooperation:

-

Other information:

-

521340S: Communications Networks I, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Savo Glisic

Opintokohteen kielet: English

ECTS Credits:

5

Language of instruction:

English

Timing:

Fall, periods 1-3

Learning outcomes:

Upon completing the required coursework, the student is able to list the functionalities of different layers of OSI and TCP/IP protocol models. The course gives the skills for the student to describe the basic structure of GSM, GPRS, EDGE, LTE and IEEE802.11 systems. The student is able to describe the basic protocol model of the UMTS radio interface and radio access network. The student knows the basic properties of routing protocols in ad hoc networks. The student will achieve skills to describe the main principles of mobility control, network security, cross-layer optimization. The course also gives the student the ability to explain the essential features of sensor networks.

Contents:

Communications architecture and protocols, adaptive network and transportation layers, mobility management, network security, network management, ad hoc and sensor networks, cross-layer optimization, examples of wireless communication networks.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h and the compulsory design work with a simulation program (15 h).

Target group:

1 st year M.Sc. and WCE students

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Parts from: S. Glisic & B. Lorenzo: Wireless Networks: 4G Technologies (2nd ed.), 2009; S. Glisic: Advanced Wireless Communications: 4G Cognitive and Cooperative Technologies (2nd ed.), 2007.

Assessment methods and criteria:

The course is passed with a final examination and the accepted simulation work report. The final grade is based on examination.
Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5.

Person responsible:

Savo Glisic

Working life cooperation:

-

Other information:

Objective: The aim is to present the fundamentals of the structure, protocol and structure of digital data transmission networks. Technical implementation and application of the common data and local networks are also discussed.

521485S: DSP-laboratory Work, 3,5 op

Voimassaolo: - 31.07.2012
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Miguel Bordallo Lopez
Opintokohteen kielet: English

Language of instruction:

In English.

Timing:

Period 2-6.

Learning outcomes:

The course concentrates on implementing basic algorithms and functions of digital signal processing using common modern programmable DSP processors.
Learning outcomes: After the course the student is able to use integrated design environments of digital signal processors for implementing and testing algorithms based on floating and fixed point representation.

Contents:

Sampling, quantization noise, signal generation, decimation and interpolation, FIR and IIR filter implementations, FFT and adaptive filter implementations.

Learning activities and teaching methods:

The course is based on a starting lecture and exercises that are done using development boards of modern 32-bit digital signal processors, and the respective software development tools. The course is passed by accepted and documented exercises

Recommended optional programme components:

Digital filters, computer engineering, programming skills.

521479S: Software Project, 7 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Juha Röning
Opintokohteen kielet: English

ECTS Credits:

7

Language of instruction:

Finnish/English, material available in English.

Timing:

Spring, periods 4-6.

Learning outcomes:

After completing the course, students have demonstrated their capabilities to design, develop and test real-life software. Further, they have shown their proficiency in professionally documenting their work during the assignment.

Contents:

Phases of software engineering process: requirement gathering, analysis, design, implementation, testing, (maintenance). Project-work, starting a project, project management, working with external parties, project documentation. Project related implementation techniques and tools, software documentation.

Mode of delivery:

Face-to-face and independent studies.

Learning activities and teaching methods:

Working methods: The course is done in groups of 3-4 students. The clients are typically various companies and societies. Project progress is supervised in formal reviews, where the project teams present their work as it reaches the milestones: the software requirement specification, the project plan, the software design specification, an operational prototype demonstration, the test documentation, and finally the functional software demonstration and release. In addition to formal reviews the project work is coordinated with steering group meetings. The work environment and development tools vary between projects. The number of students that can attend the course is limited.
Lectures 10 h, design project in period 4-6 180 h.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

521457A Software Engineering, 521453A Operating Systems, 521141P Elementary Programming, 521142A Embedded Systems Programming and varying project related background reading.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Pressman, R.S.: Software Engineering A Practitioner's Approach, 4th edition, Mc Graw-Hill, 1997; Phillips, D.: The Software Project Manager's Handbook, IEEE Computer Society, 2000; Project documentation; project related manuals and handbooks.

Assessment methods and criteria:

Project work and documentation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Juha Röning

Working life cooperation:

-

521423S: Embedded System Project, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Röning

Opintokohteen kielet: English

ECTS Credits:

5

Language of instruction:

Lecturing in Finnish, material available in English

Timing:

Autumn, periods 1-3.

Learning outcomes:

After passing the course a student can explain the life cycle of the embedded system, the characteristic features related to embedded systems development, and the risks involved. In addition, the student can explain the roles of the client and the system developer during the requirements specification, and the role of the iteration phase as a part of the requirements specification phase. The student can explain the factors affecting to SW/HW partitioning process, and the concept of SW/HW dualism. The student can fairly analyze the factors affecting to the selection of the processor and the operating system. The student can recognize the basic development tools used and their possible advantages and disadvantages. The student can compare various testing approaches. The student can explain how a design error affects to the final cost of the system in different phases of the development. The student can do some basic I/O programming using C programming language.

Contents:

The embedded design life cycle, the selection process, the partitioning decision, the development environment, the special software techniques, a basic toolset, JTAG/ICE, testing, I/O programming.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

The course is run in a project work in groups of two and follow up the progress reporting meetings. Lectures 20 h, laboratory exercise in period 1-3 120 h.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

521412A Digital Techniques I, 521267A Computer Engineering and Embedded Systems.
Also recommended 521275A Embedded Software Project, Principles of Electronics Design.

Recommended optional programme components:

Digital Techniques I, Computer Engineering, Embedded Systems. Also recommended Embedded Software Project, Principles of Electronics Design.

Recommended or required reading:

Berger, Arnold S. (2002) Embedded Systems Design: An introduction to Processes, Tools, & Techniques, CMP Books, USA. ISBN:1578200733.

Assessment methods and criteria:

Project work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Juha Röning

Working life cooperation:

None.

521279S: Signal Processing Systems, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannuksela, Jari Samuli

Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

English

Timing:

Autumn, periods 1-3.

Learning outcomes:

After the course the student can explain the challenges of signal processing hardware, software, and design methodologies. He is able to transform a digital filter designed with floating point arithmetic into a fixed point precision implementation, optimizing the word lengths to achieve the performance specifications. In addition, the student is able to explain the most important algorithm implementation structures and can identify their usage contexts. After the course the student has rudimentary practical skills in modeling, designing, and judging finite word length signal processing algorithms with Matlab and Simulink software tools.

Contents:

Binary and floating point arithmetic, DSP programming models and co-design, digital signal processors, algorithms and implementations, including CORDIC, transforms (FFT and DCT), multi-rate signal processing, polyphase filters, filter banks, adaptive algorithms and applications. The software environments of the course are Matlab with the Fixed Point Toolbox extension and Simulink with the DSP Blockset extension.

Mode of delivery:

Lectures, independent work, group work.

Learning activities and teaching methods:

The course consists of lectures (30 h) and design exercises (6-12 h). the rest as independent work (33h).

Target group:

Computer Science and Engineering students: This is an advanced-level course intended for masters-level students, especially to those that are specializing into signal processing.
+ other Students of the University of Oulu.

Prerequisites and co-requisites:

521337A Digital Filters, 521267A Computer Engineering

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

 Lecture notes and exercise materials. Material is in English.

Assessment methods and criteria:

Final exam and approved design exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Jari Hannuksela

Working life cooperation:

No.

A452271: Advanced Module/Information Technology, Signal Processing (obligatory), 13,5 - 20 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory courses

521404A: Digital Techniques 2, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Electrical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Lahti
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

In Finnish.

Timing:

Period 1-3.

Learning outcomes:

After completing this course the student knows the common architectures of synchronous digital logic circuits, and the building blocks they consist of, and can design digital circuits that realize complex data and signal processing functions.

Contents:

1. Logical and physical properties of digital logic components. 2. Representation of digital designs. 3. Combination logic design. 4. Sequential logic design. 5. Digital artithmetics. 6. Semiconductor memories. 7. Register transfer level architecture design. 8. Register transfer level modeling and synthesis. 9. Timing design. 10. Digital interface design. 11. Design verification.

Mode of delivery:

Classroom

Learning activities and teaching methods:

Lectures 24h/ exercises 30h (group work)/independent work 84h.

Target group:

Finnish BSc students.

Prerequisites and co-requisites:

Digital techniques I.

Recommended optional programme components:

-

Recommended or required reading:

Lecture textbook (in finnish) and literature announced during course.

Assessment methods and criteria:

Final exam or term exams, and a design excercise.
Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

1-5, the grade is the average of the exam and the design exercise.

Person responsible:

Jukka Lahti

Working life cooperation:

-

Other information:

-

521321S: Elements of Information Theory and Coding, 5 op

Voimassaolo: 14.11.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Timo Kokkonen, Juntti, Markku Johannes

Opintokohteen kielet: English

Leikkaavuudet:

    521323S   Wireless Communications I   5.0 op

ECTS Credits:

5

Language of instruction:

In English.

Timing:

Fall, periods 1-3

Learning outcomes:

Upon completing the required coursework, the student is able to use the basic methodology of information theory to calculate the capacity bounds of communication and data compression systems. He can estimate the feasibility of given design tasks before the execution of the detailed design. What is more, she can independently search for information and knowledge related to communication engineering, system design and signal processing. The student understands the operating principles of block codes, cyclic codes and convolutional codes. He can form an encoder and decoder for common binary block codes, and is capable of using tables of the codes and shift register when solving problems. She can represent the operating idea of a convolutional encoder as a state machine, the student is able to apply the Viterbi algorithm to decoding of convolutional codes, and is capable of specifying principles of turbo coding and coded modulation. Moreover, he can evaluate error probability of codes and knows practical solutions of codes by name.

Contents:

Entropy, mutual information, data compression, basics of source coding, discrete channels and their capacity, the Gaussian channel and its capacity, rate distortion theory, introduction to network information theory, block codes, cyclic codes, burst error correcting codes, error correcting capability of block codes, convolutional codes, Viterbi algorithm, concatenated codes, and introduction to turbo coding and to coded modulation.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40 h, exercises 20 h

Target group:

1 st year M.Sc. and WCE students

Prerequisites and co-requisites:

Signal Analysis, Telecommunication Engineering II

Recommended optional programme components:

Wireless Communications I

Recommended or required reading:

Parts from books Thomas M. Cover & Joy A. Thomas: Elements of Information Theory, 2nd ed. John Wiley & Sons, 2006 ISBN-13 978-0-471-24195-9, ISBN-10 0-471-24195-4, and S. Benedetto and E. Biglieri: Principles of Digital Transmission with Wireless Applications, 1999, Chapters 3, 10 and in part 11 and 12. Lecture notes and other literature.

Assessment methods and criteria:

The course is passed with weekly exams (only during lecture periods) or with final exam.

Grading:

The course unit utilizes a numerical grading scale 1-5.
Read more about assessment criteria at the University of Oulu webpage.

Person responsible:

Markku Juntti / Timo Kokkonen

Working life cooperation:

-

Other information:

-

521280S: DSP Laboratory Work, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Miguel Bordallo Lopez, Teemu Nyländen
Opintokohteen kielet: English

ECTS Credits:

5

Language of instruction:

In English.

Timing:

Periods 2-6 (it can be done from November to May).
Autumn and Spring.

Learning outcomes:

After the course the student is able to use integrated design environments of digital signal processors for designing, implementing and testing signal processing algorithms.

Contents:

Algorithm design, Sampling, quantization noise, signal generation, decimation and interpolation, FIR and IIR filter implementations, FFT implementations, DSP-assembly coding and optimization, Multi-rate signal processing, LMS adaptive filters implementations, CIC filtering.

Mode of delivery:

Starting lectures and independent exercises.

Learning activities and teaching methods:

The course is based on a starting lecture and exercises that are done using development boards of modern 32-bit digital signal processors, and the respective software development tools. The course is passed by accepted and documented exercises.

Target group:

Students interested in signal processing, processor architectures, embedded systems programming. Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

521337A Digital filters, 521267A Computer Engineering, programming skills.

Recommended optional programme components:

521279S Signal processing systems. This course provides complementary information on the DSP-laboratory Work course.

Recommended or required reading:

Exercise instruction booklet, processor handbooks and develop-ment environment handbooks. All material is in English.

Assessment methods and criteria:

The exercises will be passed or failed according to the functionality and overall quality.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Miguel Bordallo López

Working life cooperation:

No.

521146S: Research Methods in Computer Science, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Vasileios Kostakos

Opintokohteen kielet: English

Leikkaavuudet:

   813621S   Research Methods   5.0 op

Timing:

Autumn, periods 2-3.

Learning outcomes:

Upon completing the course the student is able to explain the scientific method, create a research plan, design and conduct experimental studies for computer science, write in academic style, and give presentations.

Contents:

Scientific method, research planning, statistics, research tools, research methods, studying humans, academic writing, presentation skills.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

No prior courses are required.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete four individual activities throughout the semester: develop a research plan (20%), complete statistics tests (20%), generate graphs and figures (20%), conduct a mini experiment (40%). Passing criteria: all four elements (research plan, statistics tests, graphs and figures, mini experiment) must be completed, each receiving more than 50% of the available points.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Vassilis Kostakos

A452272: Advanced Module/Information Technology, Signal Processing (optional), 15 - 22 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional courses, module size approx. 35 cr

521320S: Wireless Communications I, 8 op

Voimassaolo: 01.08.2007 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Electrical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jari Iinatti
Opintokohteen kielet: English
Leikkaavuudet:

521395S	Wireless Communications I	5.0 op
521323S	Wireless Communications I	5.0 op

ECTS Credits:

8

Language of instruction:

English

Timing:

Fall, periods 1-3

Learning outcomes:

After completing the course the student can analyze the performance of multilevel digital modulation methods in AWGN channel. She/he can explain the effect of fading channel on the performance of the modulation method and can analyze the performance. She/he recognizes the suitable diversity methods for

fading channel and related combining methods. Student can define the basic carrier and symbol synchronization methods and is able to make the performance comparison of them. Student can explain design methods signals for band-limited channels and can classify different channel equalizers, and perform the performance analysis. In addition, the student can utilize channel capacity evaluation for fading channels, he/she recognizes the basic methods for link adaptation and multi-antenna communication.

Contents:

Radio channel models, channel capacity, digital modulation method and their performance in AWGN-channel, carrier and symbol synchronization, performance of digital modulation in fading channel, diversity techniques, adaptive modulation and coding, multi-antenna techniques and channel equalizers in wireless communication.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40 h, exercises 20 h and the compulsory antenna design work with a simulation program (20 h)

Target group:

1 st year M.Sc. and WCE students

Prerequisites and co-requisites:

Telecommunication Engineering II, / Broadband communication systems

Recommended optional programme components:

Recommended **:** Statistical Signal Processing

Recommended or required reading:

Parts of book: Andrea Goldsmith: Wireless Communications, Cambridge University Press, 2005. Parts of J. G. Proakis: Digital Communications, 4th ed, McGraw Hill, 2001. Also, additional material from other sources.

Assessment methods and criteria:

The course is passed with final examination (during lecture periods possibility to pass with intermediate exams) and accepted design exercise. Grade is based on exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5.

Person responsible:

Jari Iinatti

Working life cooperation:

-

Other information:

Replaced by 521320S Wireless Communications I. Objective: Understanding of the basic theory and the knowledge of different fields required in digital communication are deepened. Also, communication techniques in fading channels are discussed. An overview of wireless communication systems is given, and ability to design simple communication receivers is created.

521273S: Biosignal Processing, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Tapio Seppänen
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

Lectures are given in Finnish or in English. Laboratory work is given in Finnish and English. The examination can be taken in Finnish or English.

Timing:

Autumn, periods 2 and 3.

Learning outcomes:

After passing the course, student knows special characteristics of the biosignals and typical signal processing methods. Student can solve small-scale problems related to biosignal analysis.

Contents:

Biomedical signals. Digital filtering. Time-domain and frequency-domain analysis, Nonstationarity of biomedical signals. Event detection. Signal characterization.

Mode of delivery:

 Face-to-face teaching.

Learning activities and teaching methods:

Lectures 10 hours (5 times 2 hours) and laboratory work 20 hours (10 times 2 hours), the rest as independent work, written exam.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

The mathematical studies of the BSc of computer science and engineering or equivalent studies, digital filtering, programming skills.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

The course is based on the book "Biomedical Signal Analysis, A Case-Study Approach", R.M Rangayyan. 516 pages. + Lecture transparencies + Task assignment specific material.

Assessment methods and criteria:

Laboratory work is supervised by assistants who also check that the task assignments are completed properly. The course ends with a written exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Tapio Seppänen

Working life cooperation:

No.

470444S: Advanced Control Methods, 6 op

Voimassaolo: - 31.07.2010

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Process and Environmental Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Manne Tervaskanto, Ikonen, Mika Enso-Veitikka

Opintokohteen kielet: Finnish
Leikkaavuudet:

477607S   Advanced Control and Systems Engineering   5.0 op

Ei opintojaksokuvauksia.

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:
8
Language of instruction:
Finnish/English.
Timing:
Autumn and spring, periods 1-6.
Learning outcomes:
The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.
Contents:
 A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:
Self-study.
Learning activities and teaching methods:
First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:
Computer Science and Engineering students + Other Students of the University of Oulu.
Prerequisites and co-requisites:
A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:
Course assessment is based on the technical report and oral presentation.

Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Timo Ojala.

Working life cooperation:

-

521373S: Communication Signal Processing I, 6 op

Voimassaolo: 01.08.2004 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Juntti, Markku Johannes

Opintokohteen kielet: English

Leikkaavuudet:

521324S   Statistical Signal Processing 2   5.0 op

ECTS Credits:

6

Language of instruction:

English

Timing:

Spring, periods 4-5

Learning outcomes:

Upon completing the required coursework, the student is able to use the methodology of signal processing to design communication systems and their receivers. He or she will be able to design and implement various equalizer algorithms. The student can estimate the complexity of various equalizer algorithms.

Contents:

Communication receiver as a statistical optimization problem, optimal linear filters, matrix algorithms, adaptive algorithms, linear and nonlinear equalizers, multi-antenna signal processing.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h, exercises 16 h and the compulsory design work with a simulation program (16 h).

Target group:

2nd year M.Sc. and WCE students

Prerequisites and co-requisites:

Statistical signal processing, Telecommunication Engineering II, Wireless Communications I

Recommended optional programme components:

-

Recommended or required reading:

Parts from books: Jinho Choi: Adaptive and Iterative Signal Processing in Communications, Cambridge University Press, 2006 (318 pages) ISBN-13 978-0-521-86486-2 and Simon Haykin: Adaptive Filter Theory, 3rd ed. Prentice Hall, 1996. (989 pages) ISBN: 0-13-322760-X. Lecture notes and other literature.

Assessment methods and criteria:

The course is passed with a final examination and the accepted simulation work report. In the final grade of the course, the weight for the examination is 0.75 and that for the simulation work 0.25.
Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5.

Person responsible:

Markku Juntti

Working life cooperation:

-

Other information:

Objective: Statistical signal processing methods are applied to design the key functionalities of a communication receiver and in particular its equalizer. In addition, the expertise on statistical and adaptive signal processing is deepened and enlarged regarding linear estimation, adaptive signal processing and multi-antenna signal processing.

521281S: Application Specific Signal Processors, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Boutellier, Jani Joosefi

Opintokohteen kielet: English

ECTS Credits:

5

Language of instruction:

In English.

Timing:

Spring, periods 4-5.

Learning outcomes:

Objective: The course introduces the main types of processors used in digital signal processing. Practical skills are learned by processor construction exercises.

Learning outcomes: After completing the course the student can distinguish the main types of signal processors and design a couple of transport triggered architecture processors. The student is able to assemble a signal processor out of basic entities and match the processor performance and the application requirements. The student applies the TTA codesign environment and Altera's FPGA tools to synthesize a system.

Contents:

Examples of modern signal processing applications, main types of signal processors, parallel signal processing, transport triggered architectures, algorithm-architecture matching, TCE design environment and Altera FPGA tools.

Mode of delivery:

Lectures, independent work, group work.

Learning activities and teaching methods:

Lectures 12h (participation mandatory); Instructed labs 12h ;Independent work 111h

Target group:

Computer Science and Engineering students + other Students of the University of Oulu. This is an advanced-level course intended for masters-level students and post-graduate students, especially to those who are specializing into signal pro-cessing.

Prerequisites and co-requisites:

521267A Computer engineering, 521337A digital filters, programming skills

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Handouts.

Assessment methods and criteria:

Participation in mandatory classes and approved project work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Jani Boutellier

Working life cooperation:

No.

521493S: Computer Graphics, 7 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Guoying Zhao

Opintokohteen kielet: English

Leikkaavuudet:

521140S   Computer Graphics   5.0 op

ECTS Credits:

7

Language of instruction:

In English.

Timing:

Spring, periods 5-6.

Learning outcomes:

Upon completing the required coursework, student is able to specify and design 2D graphics algorithms including: line and circle drawing, polygon filling and clipping, and 3D computer graphics algorithms including transformations, viewing, hidden surface removal, shading, texture mapping and hierarchical modeling. Moreover, student is able to explain the relationship between the 2D and 3D versions of such algorithms, and also has the necessary basic skills to use these basic algorithms available in OpenGL.

Contents:

The history and evolution of computer graphics; 2D graphics including: line and circle drawing, polygon filling, clipping, and 3D computer graphics algorithms including viewing transformations, shading, texture mapping and hierarchical modeling; graphics API (OpenGL) for implementation.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures (40 hours) and self-study (50 h). In addition student will independently solve programming assignments (100 hours).

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

Pro-gramming skills using C++; basic data structures; simple linear algebra. Additionally recommended prerequisite is the completion of the following course prior to enrolling for course unit: 521267A Computer Engineering.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

1) Textbook: Edward Angel: Interactive Computer Graphics, 5th, Addison-Wesley 2008
2) Reference: Peter Shirley, Michael Ashikhmin, Michael Gleicher, et al. : Fundamentals of Computer Graphics, second edition, AK Peters, Ltd. 2005
3) Lecture notes (in English)
4) Materials in the internet (e.g. OpenGL redbook)
   • OpenGL Programming Guide or 'The Red Book':
http://unreal.srk.fer.hr/theredbook/
   • OpenGL Video Tutorial:
http://www.videotutorialsrock.com/opengl_tutorial/what_is_opengl/text.php

Assessment methods and criteria:

The assessment of the course is based on the exam (50%) and returned course work (50%).
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Guoying Zhao, Jie Chen, Jukka Holappa

Working life cooperation:

-

521445S: Digital Techniques 3, 6 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Electrical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Lahti
Opintokohteen kielet: Finnish

ECTS Credits:
6
Language of instruction:
In Finnish.
Timing:
Period 5-6
Learning outcomes:
After completing this course the student knows the phases of the design process of hardware parts of digital system implemented in FPGA or ASIC technologies, and understands their purpose, and the problems and aims associated with different design tasks. The student is also able to use the tools needed in industrial design projects.
Contents:
1. Digital systems design process. 2. System level design and modeling of digital systems. 3. Architecture level synthesis of digital circuits. 3. FPGA circuit design and verification (technology choice, logic synthesis, physical synthesis and timing analysis) 4, ASIC-design and verification (technology choice, logic synthesis, physical synthesis, timing analysis, power analysis, design for testability).
Mode of delivery:
Classroom
Learning activities and teaching methods:
Lectures 20h/ exercises 20h (group work)/independent work 120h.
Target group:
-

Prerequisites and co-requisites:

Digital techniques I + II

Recommended optional programme components:

-

Recommended or required reading:

Lecture textbook (in finnish) and literature announced during course.

Assessment methods and criteria:

Final exam or term exams, and a design excercise
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5, the grade is the average of the exam and the design exercise.

Person responsible:

Jukka Lahti

Working life cooperation:

-

Other information:

-

521360S: Communication Signal Processing II, 4 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Juntti, Markku Johannes

Opintokohteen kielet: English

Leikkaavuudet:

   521325S   Synchronisation for Digital Receivers   5.0 op

ECTS Credits:

4

Language of instruction:

English

Timing:

Fall, periods 2-3

Learning outcomes:

After completing the course the student recognizes the blocks of all-digital receiver and can explain the basis for them. She/he can derive the key algorithms of the receiver and perform joint optimization of transmitter and receiver. The student can design the synchronization algorithms of a receiver and the related filtering and sample rate conversions. He/she can derive the performance of the algorithms and methods to compare them. In addition, she/he can utilize and develop algorithms for fading channels.

Contents:

Filter banks, synthesis and performance of synchronization algorithms in AWGN channels, frequency estimation, interpolation in synchronization, synchronization and channel estimation in fading channels, transceiver optimization, the impact of a cyclic prefix or guard interval.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 20 h and exercises 25 h out of which some are Matlab based problems.

Target group:

1 st and 2 nd year M.Sc. and WCE students

Prerequisites and co-requisites:

Statistical Signal Processing, Wireless Communications I.

Recommended optional programme components:

Recommended: Communication Signal Processing I

Recommended or required reading:

Parts from books: P. P. Vaidyanathan, S.-M. Phoong & Y.-P. Lin, Signal Processing and Optimization for Transceiver Systems, Cambridge University Press, 2010 ISBN 978-0-521-76079-9 and H. Meyr, M. Moeneclaey & S. A. Fechtel, Digital Communication Receivers: Synchronization, Channel, Estimation and Signal Processing. John Wiley, 1998. Lecture notes and other literature.

Assessment methods and criteria:

The course is passed with final examination and by solving homework problems. Grade is based on exam. Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5.

Person responsible:

Markku Juntti

Working life cooperation:

-

Other information:

Objective: Digital communication knowledge is deepened by applying the statistical signal processing techniques to the design and optimization of receiver baseband algorithms. The main goal is to learn the principles which are used to optimize the transmitter and receiver based on communication, information, detection and estimation theories.

A452273: Advanced Module/Information Technology, Intelligent Systems (obligatory), 14 - 17 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory courses

521146S: Research Methods in Computer Science, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Vasileios Kostakos
Opintokohteen kielet: English
Leikkaavuudet:

   813621S   Research Methods   5.0 op

Timing:

Autumn, periods 2-3.

Learning outcomes:

Upon completing the course the student is able to explain the scientific method, create a research plan, design and conduct experimental studies for computer science, write in academic style, and give presentations.

Contents:

Scientific method, research planning, statistics, research tools, research methods, studying humans, academic writing, presentation skills.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

No prior courses are required.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete four individual activities throughout the semester: develop a research plan (20%), complete statistics tests (20%), generate graphs and figures (20%), conduct a mini experiment (40%). Passing criteria: all four elements (research plan, statistics tests, graphs and figures, mini experiment) must be completed, each receiving more than 50% of the available points.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Vassilis Kostakos

521493S: Computer Graphics, 7 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Guoying Zhao
Opintokohteen kielet: English
Leikkaavuudet:

    521140S   Computer Graphics   5.0 op

ECTS Credits:

7

Language of instruction:

In English.

Timing:

Spring, periods 5-6.

Learning outcomes:

Upon completing the required coursework, student is able to specify and design 2D graphics algorithms including: line and circle drawing, polygon filling and clipping, and 3D computer graphics algorithms including transformations, viewing, hidden surface removal, shading, texture mapping and hierarchical modeling. Moreover, student is able to explain the relationship between the 2D and 3D versions of such algorithms, and also has the necessary basic skills to use these basic algorithms available in OpenGL.

Contents:

The history and evolution of computer graphics; 2D graphics including: line and circle drawing, polygon filling, clipping, and 3D computer graphics algorithms including viewing transformations, shading, texture mapping and hierarchical modeling; graphics API (OpenGL) for implementation.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures (40 hours) and self-study (50 h). In addition student will independently solve programming assignments (100 hours).

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

Pro-gramming skills using C++; basic data structures; simple linear algebra. Additionally recommended prerequisite is the completion of the following course prior to enrolling for course unit: 521267A Computer Engineering.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

1) Textbook: Edward Angel: Interactive Computer Graphics, 5th, Addison-Wesley 2008
2) Reference: Peter Shirley, Michael Ashikhmin, Michael Gleicher, et al. : Fundamentals of Computer Graphics, second edition, AK Peters, Ltd. 2005
3) Lecture notes (in English)
4) Materials in the internet (e.g. OpenGL redbook)
    • OpenGL Programming Guide or 'The Red Book':
http://unreal.srk.fer.hr/theredbook/
    • OpenGL Video Tutorial:
http://www.videotutorialsrock.com/opengl_tutorial/what_is_opengl/text.php

Assessment methods and criteria:

The assessment of the course is based on the exam (50%) and returned course work (50%).
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Guoying Zhao, Jie Chen, Jukka Holappa

Working life cooperation:

-

477505S: Fuzzy-neuromethods in Process Automation, 4 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Esko Juuso
Opintokohteen kielet: Finnish
Leikkaavuudet:

   477525S   Computational intelligence in automation   5.0 op

470438S   Fuzzy Sets and Neural Networks in Process Automation   3.5 op

ECTS Credits:

4 cr

Language of instruction:

Finnish and English

Timing:

Implementation in 5 [th] period. Recommended for fourth year students (M.Sc.).

Learning outcomes:

After the course the student is capable of explaining the concepts of intelligent systems and operation principles of fuzzy set systems, neural networks, neuro-fuzzy systems and genetic algorithms. The student has skills to construct and tune fuzzy models in Matlab-Simulink environment and to explain the operation of these models. The student is able to explain in an integrating way the principle concepts of neural computing and construct neural network models in Matlab-Simulink environment. The student recognizes the key problems of the data-driven modelling and is able to choose suitable solutions which ensure generalization. The student is able to explain the operation principles of genetic algorithms and to use them in optimization. Moreover, the student is able to describe alternative solutions for dynamic models, hyperplane methods and hybrid solutions. The student can explain the key concepts of cellular automata and evolutionary computation. After the course the student is able to search other relevant programming tools.

Contents:

Fuzzy logic and fuzzy set systems, fuzzy calculus, fuzzy modeling and control, neural computation, learning algorithms, neuro-fuzzymethods, linguistic equations, evolutionary computation, hyperplane methods, cellular automata, intelligent diagnostics and decision making, adaptive intelligent systems, hybrid systems.

Mode of delivery:

Tuition is implemented mainly as face-to-face teaching.

Learning activities and teaching methods:

The amount of guided teaching is 38 hrs, including lectures, demonstrations, exercises and seminars. Totally 68,7 hrs are allocated for self-study, which consists of three parts: (1) a case study covering several topics applied in a chosen problem, (2) a seminar work concentrating on a single topic, and (3) the final report.

Target group:

M.Sc. students in process and environmental engineering, machine engineering, computer engineering and industrial engineering and management.

Prerequisites and co-requisites:

-

Recommended optional programme components:

Simulation course and Programming in Matlab course reinforce abilities for the exercises and the case study.

Recommended or required reading:

Lecture notes and exercise materials.

Assessment methods and criteria:

The assessment of the course is based on the exercises, case study, seminar and the final report. Final exam is an alternative for the final report.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit uses a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

University teacher Esko Juuso

Working life cooperation:

No

Other information:

-

A452274: Advanced Module/Information Technology, Intelligent Systems (optional), 18 - 25 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional courses, module size apporx. 35 cr

477605S: Digital Control Theory, 4 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

477624S	Control System Methods	5.0 op
470453S	Digital Control Theory	5.0 op

ECTS Credits:

4 cr

Language of instruction:

Finnish

Timing:

Periods 2 and 3

Learning outcomes:

After completing the course students can identify the problems of the sampled data systems, and know how to apply discrete time methods for systems analysis and control design.

Contents:

1. Sampled data systems: sampling, Z transformation of signals. 2. Discrete-time modelling: difference equation, shift operator, pulse transfer function, polynomial and state-space description. 3. Analysis of discrete-time systems: z-plane, stability. 4. Discrete-time control design strategies: general RST structure, various pole-zero placement control algorithms, minimum-variance control, model-based control, state-space design methods.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures and exercises include guided computer simulations.

Target group:

M.Sc. students in process and environmental engineering

Prerequisites and co-requisites:

The courses 4770xxP Introduction to process and environmental engineering II, 477602A Control system analysis and 477603A Control system design recommended beforehand

Recommended optional programme components:

-

Recommended or required reading:

Lecturer's note. Landau, I. & Zito, G. (2005) Digital Control Systems, Springer. 485 pp. Åström, K.J. & Wittenmark, B. (1984, 1997) Computer Controlled Systems: Theory and Design. Prentice-Hall International. 544 pp.

Assessment methods and criteria:

The course concludes in a written exam; to request an exam in English, contact the lecturer via email beforehand.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1..5 or fail

Person responsible:

University teacher Seppo Honkanen

Working life cooperation:

No

Other information:

-

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-6.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Timo Ojala.

Working life cooperation:

-

521273S: Biosignal Processing, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Tapio Seppänen
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

Lectures are given in Finnish or in English. Laboratory work is given in Finnish and English. The examination can be taken in Finnish or English.

Timing:

Autumn, periods 2 and 3.

Learning outcomes:

After passing the course, student knows special characteristics of the biosignals and typical signal processing methods. Student can solve small-scale problems related to biosignal analysis.

Contents:

Biomedical signals. Digital filtering. Time-domain and frequency-domain analysis, Nonstationarity of biomedical signals. Event detection. Signal characterization.

Mode of delivery:

 Face-to-face teaching.

Learning activities and teaching methods:

Lectures 10 hours (5 times 2 hours) and laboratory work 20 hours (10 times 2 hours), the rest as independent work, written exam.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

The mathematical studies of the BSc of computer science and engineering or equivalent studies, digital filtering, programming skills.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

The course is based on the book "Biomedical Signal Analysis, A Case-Study Approach", R.M Rangayyan. 516 pages. + Lecture transparencies + Task assignment specific material.

Assessment methods and criteria:

Laboratory work is supervised by assistants who also check that the task assignments are completed properly. The course ends with a written exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Tapio Seppänen

Working life cooperation:

No.

470444S: Advanced Control Methods, 6 op

Voimassaolo: - 31.07.2010
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Field of Process and Environmental Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Manne Tervaskanto, Ikonen, Mika Enso-Veitikka
Opintokohteen kielet: Finnish
Leikkaavuudet:

477607S   Advanced Control and Systems Engineering   5.0 op

Ei opintojaksokuvauksia.

521264S: Human-Computer Interaction Techniques, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

In English.

Timing:

Autumn, periods 2-3.

Learning outcomes:

Upon completing the course the student is able to explain the HCI fundamentals, explain evaluation and prototyping techniques, explain how HCI can be incorporated in the software development process.

Contents:

Human and computer fundamentals, design and prototyping, evaluation techniques, data collection and analysis.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

No prior courses are required.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete three group-based activities throughout the semester: design & prototyping (40%), conduct an evaluation (40%), and complete a report of the activities (20%). Passing criteria: all 3 elements (designs, evaluation, report) must be completed, each receiving more than 50% of the available points.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Vassilis Kostakos

Working life cooperation:

-

802633S: Statistical Pattern Recognition, 10 op

Opiskelumuoto: Advanced Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Lasse Holmström

Opintokohteen oppimateriaali:
Duda, Richard O. , , 2001
Theodoridis, Sergios , , 2002
Webb, A. R , , 2002
Opintokohteen kielet: Finnish

ECTS Credits:

10 cr

Language of instruction:

Finnish

Timing:

Spring semester, 3rd and 4th periods.

Learning outcomes:

Upon completing the course the student will
-be familiar with the most common classifiers used in pattern recognition
-be able to apply pattern recognition methods to practical problems
-be able derive some of the basic mathematical results of pattern recognition theory

Contents:

The course focuses on the theory and practice of pattern recognition with emphasis on classifiers and feature extraction

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

42 h of lectures, 28 h of exercises

Target group:

Mathematics, applied mathematics and statistics majors. Other students with a sufficient mathematical background.

Prerequisites and co-requisites:

Calculus in one and several dimensions, linear algebra I and II. Probability theory I. Probability theory II or Random variables and distributions.

Recommended or required reading:

Lecture notes.
Optional reading:
R. O. Duda, P. E. Hart, and D. G. Stork. Pattern Classification. Wiley-Interscience, second edition, 2000.
S. Theodoridis and K. Koutroumbas. Pattern Recognition. Academic Press, 1999.
A. Webb. Statistical Pattern Recognition. Arnold, 1999 (Second edition: John Wiley & Sons Ltd, 2002).

Assessment methods and criteria:

Final exam. In the first exam following the course the student gets credit for the (possible) homework problems he/she has solved during the course.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Lasse Holmström

Working life cooperation:

No

Other information:

No

A452275: Advanced Module/Information Technology, Biomedical Information Engineering (obligatory), 11 - 20 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory courses

521146S: Research Methods in Computer Science, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Vasileios Kostakos
Opintokohteen kielet: English
Leikkaavuudet:

   813621S   Research Methods   5.0 op

Timing:

Autumn, periods 2-3.

Learning outcomes:

Upon completing the course the student is able to explain the scientific method, create a research plan, design and conduct experimental studies for computer science, write in academic style, and give presentations.

Contents:

Scientific method, research planning, statistics, research tools, research methods, studying humans, academic writing, presentation skills.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

No prior courses are required.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete four individual activities throughout the semester: develop a research plan (20%), complete statistics tests (20%), generate graphs and figures (20%), conduct a mini experiment (40%). Passing criteria: all four elements (research plan, statistics tests, graphs and figures, mini experiment) must be completed, each receiving more than 50% of the available points.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Vassilis Kostakos

521273S: Biosignal Processing, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tapio Seppänen

Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

Lectures are given in Finnish or in English. Laboratory work is given in Finnish and English. The examination can be taken in Finnish or English.

Timing:

Autumn, periods 2 and 3.

Learning outcomes:

After passing the course, student knows special characteristics of the biosignals and typical signal processing methods. Student can solve small-scale problems related to biosignal analysis.

Contents:

Biomedical signals. Digital filtering. Time-domain and frequency-domain analysis, Nonstationarity of biomedical signals. Event detection. Signal characterization.

Mode of delivery:

 Face-to-face teaching.

Learning activities and teaching methods:

Lectures 10 hours (5 times 2 hours) and laboratory work 20 hours (10 times 2 hours), the rest as independent work, written exam.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

The mathematical studies of the BSc of computer science and engineering or equivalent studies, digital filtering, programming skills.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

The course is based on the book "Biomedical Signal Analysis, A Case-Study Approach", R.M Rangayyan. 516 pages. + Lecture transparencies + Task assignment specific material.

Assessment methods and criteria:

Laboratory work is supervised by assistants who also check that the task assignments are completed properly. The course ends with a written exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Tapio Seppänen

Working life cooperation:

No.

521107S: Biomedical Instrumentation, 6 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

   521093S   Biomedical Instrumentation   5.0 op

ECTS Credits:

6

Language of instruction:

English

Timing:

5-6

Learning outcomes:

After the course the student is capable to explain principles, applications and design of medical instruments most commonly used in hospitals. He/she can describe the electrical safety aspects of medical instruments and can present the physiological effects of electric current on humans. In addition the student is able to explain medical instrumentation development process and the factors affecting it. He/she also recognizes typical measurands and measuring spans and is able to plan and design a biosignal amplifier.

Contents:

Diagnostic instruments (common theories for medical devices, measurement quantities, sensors, amplifiers and registering instruments). Bioelectrical measurements (EKG, EEG, EMG, EOG, ERG), blood pressure and flow meters, respiration studies, measurements in a clinical laboratory, introduction to medical imaging methods and instruments, ear measurements, heart pacing and defibrillators, physical therapy devices, intensive care and operating room devices and electrical safety aspects.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures/exercises 54 h and self-study 100 h.

Target group:

Students interested in biomedical measurements.

Prerequisites and co-requisites:

None

Recommended optional programme components:

Course replaces course 521126S Biomedical measurements

Recommended or required reading:

R. S. Khandpur: Biomedical Instrumentation, Technology and Applications, McGraw-Hill, 2005 and J. G. Webster: Medical Instrumentation, Application and Design, 4th edition, John Wiley & Sons, 2010.

Assessment methods and criteria:

The course is passed by the final exam or optionally with the assignments/test agreed at the first lecture Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5

Person responsible:

Igor Meglinski

Working life cooperation:

None

Other information:

None.

A452276: Advanced Module/Information Technology, Biomedical Information Engineering (optional), 20 - 24 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional courses, module size approx. 35 cr

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-6.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Timo Ojala.

Working life cooperation:

-

080910A: Applied Diagnostic Radiology, 4 op

Voimassaolo: - 31.07.2016
Opiskelumuoto: Intermediate Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

4 ECTS

Language of instruction:

Finnish

Timing:

Master studies, autumn-spring (the course isorganised every other year).

Learning outcomes:

The student can explain the basic principles of medical imaging technoqies, possibilities of use and limitations. The student can define how and by what conditions are required to produce an image with acceptable diagnostic quality and what features are essential for interpreting images.

Contents:

Course gives insight to radiological work (conventional X-rays, computed tomography, ultrasound examinations, magnetic resonance imaging and radiological operations). Seminars include radiological examinations from the technical point of view combining technical and medical knowledge.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 20 hrs. Seminars and demonstrations 20 hrs. Selected lectures from the course 080602A (see the ECTS guide for the Faculty of Medicine). Final exam.

Target group:

Students of Medical Technology (medical and wellness technology, biophysics, students of medical technology from faculty of technology)

Recommended or required reading:

S Soimakallio (ed), L Kivisaari, H Manninen, E Svedström, O Tervonen. Radiologia, WSOY, 2005.

Assessment methods and criteria:

Seminar presentation and final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5 or fail, seminar weighted as 2/3 and final exam grade as 1/3 in the final grade.

Person responsible:

Dr. Pasi Pulkkinen

Working life cooperation:

No

Other information:

This course is not being organized any more.

080901A: Introduction to Technology in Clinical Medicine, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Jämsä, Timo Jaakko
Opintokohteen kielet: Finnish

ECTS Credits:

6 credits

Language of instruction:

Finnish

Timing:

2nd year, autumn

Learning outcomes:

The student can list technologies in different fields of medical technology, can describe the working principle of these technologies and evaluate the advantages and limitationc of the technologies.

Contents:

Course introduction lectures. Specialists from different clinical areas give lectures and demonstrations, in which main themes and terms of the field are introduced and technical equipment and methods are presented.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Initial exam. Lectures 35 hours, demonstrations 30 hours, written work. Final exam.

Target group:

Students of Medical Technology (medical and wellness technology, biophysis, other degree programs)

Recommended or required reading:

Boook of initial exam T. Sora, P. Antikainen, M. Laisalmi, S. Vierula: Sairaanhoidon teknologia, WSOY 2002. The material addressed during the lectures.

Assessment methods and criteria:

Initial exam and written work. Taking part in the lectures and demos. Written final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5

Person responsible:

Professor Timo Jämsä

Working life cooperation:

No

764638S: Basic Neuroscience, 5 op

Voimassaolo: 01.01.2009 -
Opiskelumuoto: Advanced Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

764338A   Basic Neuroscience   5.0 op

ECTS Credits:

5 credits

Language of instruction:

English

Timing:

3. - 4. spring

Learning outcomes:

Student will be able to explain basic oganization and functions of the nervous system.

Contents:

See 764338A Basic Neuroscience

Assessment methods and criteria:

Read more about assessment criteria at the University of Oulu webpage.

Person responsible:

Mikko Vähäsöyrinki, Matti Weckström, Kyösti Heimonen

753124P: Concepts of genetics, 4 - 7 op

Voimassaolo: - 31.07.2015
Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Kuittinen, Helmi Helena, Savolainen Outi
Opintokohteen kielet: Finnish
Leikkaavuudet:

757109P   Concepts of genetics   5.0 op

ECTS Credits:

4-7 ECTS credits / 107-187 hours of work.

Language of instruction:

Finnish.

Timing:

B.Sc. 1 st spring.

Learning outcomes:

To understand and apply basic concepts of genetics, at Mendelian and molecular level .

Contents:

Part 1. Mendelian genetics, including the ideas of quantitative and population genetics. Part 2. Molecular genetics: replication, transcription, translation, genetic code, mutations, repair of DNA. Part 3. Selected topics on developmental genetics, and genetics of health and diseases.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

72 h lectures and seminars, 115 h independent studies, exam.

Target group:

Compulsory to the biology students (7 cr.) Biochemistry students: parts 1 and 3 (4 cr.) compulsory, biophysics students.

Prerequisites and co-requisites:

Cell biology (750121P) or equivalent knowledge.

Recommended optional programme components:

This course is prerequisite to all other genetics courses.

Recommended or required reading:

Materials are in Optima. Klug et al. 2012. Concepts of Genetics (10. ed). Pearson, 896 p. Alberts, B. et al. 2008: Molecular Biology of the Cell (5. ed). Garland Science Publishing, London, 1268 p.
The availability of the literature can be checked from this link.

Assessment methods and criteria:

Homeworks, home exams, lecture diary, exams.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5 / Fail.

Person responsible:

Prof. Outi Savolainen.

Working life cooperation:

No.

Other information:

-

750340A: Basics of bioinformatics, 3 op

Voimassaolo: - 31.07.2016
Opiskelumuoto: Intermediate Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English
Leikkaavuudet:

   757314A   Basics of bioinformatics   5.0 op

ECTS Credits:

3 ECTS credits / 80 hours of work.

Language of instruction:

Finnish / English.

Timing:

B.Sc. studies, 2nd spring.

Learning outcomes:

After the course the student knows and is able to use the basic methods for handling the nucleotide and protein sequences. The aim is that the student learns how to use the databases, understands the background and principles of the analytic methods, is able to take up a critical attitude towards the used methods and gets a good background for applying new methods that are developed continuously.

Contents:

Searching of material from the databases, inferring the function of a gene and structure of a protein based on sequence data, comparing the sequences and evaluating the differences between them as well as examining the evolution history of the genes.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

12 h lectures, 2 h seminar, 20 h exercises, independent work.

Target group:

BT: compulsory, recommended for all biologists. Suitable also for biochemists.

Prerequisites and co-requisites:

Course Concepts of genetics (753124P) compulsory, also Molecular evolution (753327A) is recommended.

Recommended optional programme components:

-

Recommended or required reading:

Pevsner, Jonathan 2009: Bioinformatics and Functional Genomics.Wiley-Blackwell, cop. 2009.
The availability of the literature can be checked from this link.

Assessment methods and criteria:

Reports or exam, exercises, seminar presentation, independent work and student activity.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5 / Fail

Person responsible:

Dr. Tanja Pyhäjärvi.

Working life cooperation:

No.

Other information:

-

764103P: Introduction to biophysics, 2 op

Voimassaolo: 01.08.2009 -
Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

764163P-02   Basic biophysics (part 2)   0.0 op
764163P   Basic biophysics   5.0 op
764163P-01   Introduction to Biomedical Physics (part 1)   0.0 op

ECTS Credits:

2 credits

Language of instruction:

Finnish

Timing:

1st autumn

Learning outcomes:

Student knows some basics and concepts of certain areas of biophysics and central targets of biophysical research.

Contents:

The course introduces some basic biological processes from biophysics point of view, and describes certain basics of biophysical research.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 14 h, self-study 39 h

Target group:

Mainly students in Physics B.Sc. program. Also for the other students of the University of Oulu.

Prerequisites and co-requisites:

No specific prerequisites

Recommended optional programme components:

No alternative course units or course units that should be completed simultaneously

Recommended or required reading:

Lectures and lecture notes.

Assessment methods and criteria:

Home exam (written essay)
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 0 – 5, where 0 = fail

Person responsible:

Kyösti Heimonen, Marja Hyvönen

Working life cooperation:

No work placement period

Other information:

https://wiki.oulu.fi/display/764103P/

A452286: Advanced module/Applied computing technology (optional), 25 - 40 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional courses, module size approx. 35 credits

521264S: Human-Computer Interaction Techniques, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

In English.

Timing:

Autumn, periods 2-3.

Learning outcomes:

Upon completing the course the student is able to explain the HCI fundamentals, explain evaluation and prototyping techniques, explain how HCI can be incorporated in the software development process.

Contents:

Human and computer fundamentals, design and prototyping, evaluation techniques, data collection and analysis.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

No prior courses are required.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete three group-based activities throughout the semester: design & prototyping (40%), conduct an evaluation (40%), and complete a report of the activities (20%). Passing criteria: all 3 elements (designs, evaluation, report) must be completed, each receiving more than 50% of the available points.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Vassilis Kostakos

Working life cooperation:

-

812346A: Object Oriented Analysis and Design, 6 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Information Processing Science
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:
6 ECTS credits/160 hours of work

Language of instruction:
Finnish. If at least four non-Finnish student take the course, English exercises group is organised.

Timing:

2nd year, autum semester, period 1

Learning outcomes:

After completing the course, the students know possibilities of UML-language family to describe different views. They can picture a task using Use cases and scenarios. Moreover they can produce detailed descriptions using activity-, class-, interaction- and state diagrams. They know principles of object-orientedness and can use abstract as well interface classes. Additionally they can model user interface by state diagrams. They understand what design patterns are and how they are described and categorised.

Contents:

Principles of object orientation and object-oriented programming; quality criteria of object orientation; design patterns; case use; activity, class, interaction and state machine diagrams; class realisation.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30h, compulsory exercises and assignments 28h, independent work 102h.

Prerequisites and co-requisites:

Basic knowledge of programming and information systems analysis and design.

Recommended optional programme components:

We recommend to take also the course Object-oriented programming (812347A).

Recommended or required reading:

Bennet, McRobb & Farmer: Object-oriented systems analysis and design, Using UML

Assessment methods and criteria:

Examination. At least 50% on points needed for passing the course.

Grading:

1-5

Person responsible:

Juha Iisakka

Working life cooperation:

No

812347A: Object-Oriented Programming, 6 op

Voimassaolo: - 31.07.2015
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Information Processing Science
Arvostelu: 1 - 5, pass, fail
Opettajat: Ari Vesanen
Opintokohteen kielet: Finnish

ECTS Credits:

6 ECTS credits/160 hours of work

Language of instruction:

Finnish

Timing:

2nd year, autumn semester, period 1

Learning outcomes:

After completing the course, the student is able to explain the general objectives and techniques of object-oriented programming paradigm. Furthermore, the student can describe the practical meaning of concepts of object-oriented programming. The student can construct C++ programs that apply inheritance, composition and polymorphism. Finally, the student is able to describe most common design patterns and to design and construct programs that contain the design patterns presented in the course.

Contents:

Introduction to object-orientation, basics of programming in C++ language, composition, inheritance and polymorphism, design patterns, generics, C++ standard template library and containers.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 32h, laboratory exercises 21h, weekly assignments and independent work 107h

Target group:

Prerequisites and co-requisites:

Courses "811192P Introduction to Programming in C", "811175P Programming Assignment" or similar knowledge.

Recommended optional programme components:

Recommended or required reading:

• Timothy Budd: Introduction to object-oriented programming, 3rd edition.
• Erich Gamma, Richard Helm, Ralph Johnson & John Vlissides: Design patterns – Elements of reusable object-oriented software.
• Bruce Eckel: Thinking in C++ Volume 1, 2nd edition.

Assessment methods and criteria:

Weekly assignments (preferred) or final exam + programming assignment
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5

Person responsible:

Ari Vesanen

Working life cooperation:

No

812335A: Interaction Design, 4 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Information Processing Science

Arvostelu: 1 - 5, pass, fail

Opettajat: Netta Iivari, Anna-Liisa Syrjänen

Opintokohteen kielet: English

ECTS Credits:

4 ECTS credits/108 hours of work

Language of instruction:

English

Timing:

1st year of Master's studies, autumn semester period 2

Learning outcomes:

Objective: The course explains the role of human interaction with products and services, explains the factors and problems related to it to motivate interaction design, and teaches some methods for analysis, evaluation and design of interactions.

Learning Outcomes: After completing the course, the student can assess the role of human interaction with information technological products or services and identify factors and problems related to it within a practical design case. The student is able to:

- use methods for analysis and evaluation of existing interfaces;
- understand the role of requirements, plan and conduct a simple requirements collection and analysis;
- use basic principles of usability for graphical user interface design;
- use interaction design methods to create a novel or redesigned interactive product.

Contents:

The first part provides an overview of interaction design, introducing the key issues and activities of the subject: the terminology and fundamental concepts of the area; the main activities involved in interaction design, and the importance of user involvement in the design process. Part two addresses the key activity in interaction design: establishing requirements for an interactive product and focusing on making the product usable for the intended population. The third part covers the techniques and knowledge necessary to design an interactive product that is accessible and useful to the people who are expected to use it. Part four presents the techniques and knowledge necessary to design and evaluate an interactive product.

Mode of delivery:

Face-to-face teaching, self-study

Learning activities and teaching methods:

Lectures 18h, assignments or one larger assignment and presentation 56h, exam 34h.

Target group:

Master's level students of the IS Oriented Module (compulsory), Master's level students of the SE Oriented Module (optional) and GS ^{3}D students (optional).

Prerequisites and co-requisites:

Basic knowledge on human-computer interaction with usability and user-centered design.

Recommended or required reading:

Sharp, Rogers and Preece (2007, 2nd or later edition) *Interaction Design: Beyond Human-Computer Interaction* and lecture and assignment materials.

Assessment methods and criteria:

Assignments/assignment and presentation, exam.

Grading:

assignment pass/fail, exam 1-5

Person responsible:

 Anna-Liisa Syrjänen, itsenäinen tapa
Netta Iivari, luennot

Working life cooperation:

No

815653S: Open Source Software Development, 4 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Information Processing Science

Arvostelu: 1 - 5, pass, fail

Opettajat: Henrik Hedberg

Opintokohteen kielet: English

ECTS Credits:

4 ECTS credits/108 hours of work

Language of instruction:

English

Timing:

2 nd year of Master's studies, autumn semester, periods 1 + 2

Learning outcomes:

After completing the course, a student is able to:

- Define the historical background and the ideology of OSS;
- Participate in an OSS development project;
- Evaluate the impact of using OSS and OSS licenses in software development and exploitation;
- View the phenomenon through essential scientific research.

Contents:

Open Source Software (OSS) is one of the most topical phenomena in software development. It affects both software production and the decisions of user organisations. OSS can be studied from different social, legal, economical, software engineering and data security viewpoints. The course covers the range of scientific findings on the OSS paradigm. The course introduces the Open Source Software (OSS) development paradigm and current topics in OSS research. The aim is to study from different viewpoints, for example, what OSS is and what it is not, the history and organisation of OSS projects, methods of OSS development and usage, as well as licensing models and possible risks. The emphasis is on research work.

Mode of delivery:

Mostly face-to-face teaching but some parts are implemented as distance teaching

Learning activities and teaching methods:

Lectures and seminars about 40h, exercises about 10h, seminar paper about 58h.

Prerequisites and co-requisites:

Compulsory prerequisites are bachelor degree or other equivalent degree and basic knowledge of software engineering and research work. The course allows passing Project II following the OSS development principles or a Master's thesis on an OSS topic.

Recommended optional programme components:

Recommended or required reading:

Fogel, K. (2005): Producing Open Source Software - How to Run a Successful Free Software Project, O'Reilly Media; Rosen L. (2004): Open Source Licensing: Software Freedom and Intellectual Property Law, Prentice Hall; international articles covering the topic.

Assessment methods and criteria:

Active participation and a seminar paper
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5

Person responsible:

Henrik Hedberg

Working life cooperation:

No

815309A: Real Time Distributed Software Development, 6 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Information Processing Science

Arvostelu: 1 - 5, pass, fail

Opettajat: Petri Pulli

Opintokohteen kielet: English

ECTS Credits:

6 ECTS credits/160 hours of work

Language of instruction:

English

Timing:

1 st year of Master's studies, autumn semester, periods 1 + 2

Learning outcomes:

After completing the course, the student:

• Is able to analyse the characteristics of real-time distributed systems;
• Is able to acquire an object-oriented, model-based approach to solve the design problems found in real-time systems;
• Is able to detect and derive specific problems facing the real-time software designer, and to suggest design patterns to solve those problems.

Contents:

Introduction
1. Characteristics of real-time systems;
2. Resource management;
3. Safety and reliability;
4. Time constraints;
5. Concurrency;
6. Scheduling;
7. Multitasking, interrupts;
8. Hardware interfaces.
Characteristics of Distribution
1. Centralised;
2. Client-server;
3. Clusters ;
4. Cloud;
5. Peer-to-peer;
6. Ad hoc;
7. Concept of time;
8. Synchronisation;
9. Latency and jitter;
10. Quality of service;
11. Service discovery;
12. Networking primitives;
13. Networking platforms.

Real-Time UML Modelling Methodology
Real-Time Design Patterns
Design Examples: Embedded, Ubiquitous, Mobile, Web/Internet

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 45h, design exercises 15h, student projects 100h.

Target group:

Prerequisites and co-requisites:

Student understands computer architecture, object-oriented analysis and design (UML), programming language C and/or Java.

Recommended optional programme components:

Recommended or required reading:

Lecture notes based on reference books
• Douglass B.P. (2007) Real-Time UML – Advances in the UML for Real-Time Sys-tems. Third edition. Addison-Wesley ISBN 0-321-16076-2. 694 p.
• Douglass B.P. (2009) Real-Time Design Patterns – Robust Scalable Architecture for Real-Time Systems. Addison-Wesley ISBN 0-201-69956-7. 500 p.

Assessment methods and criteria:

Exam and project evaluation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1–5

Person responsible:

Petri Pulli

Working life cooperation:

No

817603S: System Design Methods for Information Systems, 5 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Information Processing Science
Arvostelu: 1 - 5, pass, fail
Opettajat: Li Zhao
Opintokohteen kielet: English

ECTS Credits:

5 credits/134 hours of work

Language of instruction:

English

Timing:

1 st year of Master's Studies, autumn semester, period1.

Learning outcomes:

Objective: The objective of the course is to widen students' understanding of methodologies and techniques for information systems development (ISD) and provide students with skills in using the variety of techniques.

Learning Outcomes: After the course the student understands the complexity of business, organizational, technical, and human aspects that affect ISD and the selection of methods in ISD. The student also understands the defects of traditional waterfall model and how other methods aim to answer to these defects and to other challenges in ISD. In particular, with socio-technical methods (e.g., SSM, ETHICS) and their techniques the student is able to re-plan and develop the sub-systems (automated and non-automated) of organization into a coherent whole and to take into account job satisfaction issues in addition to efficiency demands in ISD and in planning workflows in organization. The student is also able to assess and give arguments which method is suitable for an ISD project in an organization.

Contents:

What is information systems development (ISD), waterfall method, socio-technical methods like SSM and ETHICS, miscellaneous methods or frameworks like evolutionary approach, prototyping, rapid application development, Agile development, XP, business process re-engineering, process innovation, stakeholders analysis, and critical success factors, as well as how to select ISD methods.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 20h, exercises 24h, homework 30h, essay 30h, examination 30h.

Target group:

Prerequisites and co-requisites:

Bachelor studies recommended

Recommended optional programme components:

Recommended or required reading:

Avison, D., Fitzgerald, G. (2006) Information Systems Development, methodologies, techniques & tools. Fourth Edition. London: McGraw-Hill.
Research articles (to be announced during the course implementation).

Assessment methods and criteria:

Exercises, assignments, essay, and examination.

Grading:

1-5

Person responsible:

Li Zhao

Working life cooperation:

No

813624S: Information Systems Theory, 7 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Information Processing Science
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

ECTS Credits:

7 ECTS credits/187 hours of work

Language of instruction:

English

Timing:

2nd year of Master's studies, autumn semester, periods 1 + 2

Learning outcomes:

 After completing the course, the student:

• Will have a good knowledge and understanding of a broad array of research topics and themes within the field of information systems;
• Will have good knowledge and understanding of information systems research and the process by

which that research is produced;
* Can publish critical IS research articles in some of the leading academic journals and conference proceedings;
* Can critically analyse and synthesise academic sources;
* Can verbally present arguments in an academic fashion;
* Can write a literature review on an IS research topic.

Contents:

1. Information Systems Research Overview
2. A contemporary selection of IS research themes, such as:
* Information systems success and failure;
* Information systems development;
* Understanding the end-user;
* Risk management;
* Cultural Issues in information systems.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 1.5 ECTS credits (40.5h), class preparation 1.5 ECTS (40.5h), and exercises 4 ECTS (107h).

Target group:

Master's level students

Prerequisites and co-requisites:

Bachelor degree or other equivalent degree and **"Research Methods"** course (813621S). 813624S is a substantive overview of research in information systems not a methods course, and students should be familiar with research methods prior enrolling to 813624S.

Recommended optional programme components:

Recommended or required reading:

To be announced during the course implementation

Assessment methods and criteria:

Paper summary and its presentation, active participation in class, class quizzes, research proposal, and research essay are assessed. Note that there is no final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1–5

Person responsible:

Tero Vartiainen

Working life cooperation:

No

Other information:

Course material can be found at OPTIMA e-learning environment, Urkund is used for course work submissions.

A452285: Advanced module/applied computing technology (obligatory), 10 - 40 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory courses

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-6.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Timo Ojala.

Working life cooperation:

-

521152S: Applied Computing Project II, 10 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ojala, Timo Kullervo, Vasileios Kostakos

Opintokohteen kielet: English

ECTS Credits:

10

Language of instruction:

In English.

Timing:

Autumn and Spring, periods 1-6.

Learning outcomes:

Upon completing the course the student is able to complete a full cycle of interactive systems development, including requirements elicitation, system design, prototyping, testing, and evaluation. In this work, the student is able apply skills obtained in other courses.

Contents:

Project work.

Mode of delivery:

Face to face teaching, project work as collaborative team work.

Learning activities and teaching methods:

Practical work in project teams. The course is passed with an approved project work. The implementation is fully English.

Target group:

Computer Science and Engineering M.Sc. students and other Students of the University of Oulu.

Prerequisites and co-requisites:

No prior courses are required.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Dix, Finlay, Abowd & Beale: Human-Computer Interaction (http://www.hcibook.com); Rogers, Sharp & Preece: Interaction Design: Beyond Human-Computer Interaction (http://www.id-book.com).

Assessment methods and criteria:

The course uses continuous assessment so that the project work is assessed in stages: design (20% of total grade), implementation (40%), evaluation (20%), and final report (20%). Passing criteria: all stages (design, implementation, evaluation, report) must be completed with an approved grade.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Vassilis Kostakos, Timo Ojala.

A452287: Advanced module/Applied computing economy (obligatory), 10 - 40 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory courses

721412P: Product and Market Strategies, 5 op

Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Oulu Business School
Arvostelu: 1 - 5, pass, fail
Opettajat: Ilkka Ojansivu
Opintokohteen kielet: Finnish
Leikkaavuudet:

　　ay721412P　　Product and Market Strategies (OPEN UNI)　　5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5 ECTS credits / 133 hours of work

Language of instruction:
Finnish.

Timing:
Autumn semester/Period A.

Learning outcomes:
After having passed this course, students are able to identify the concepts and tools linked to product and market strategies. The course improves students' ability to evaluate different product and market situations among industries and propose solutions to strategic product/market decisions. Furthermore, students are able to explain the content and stages of the value delivery process.

Contents:
1) Discovering the required value, 2) Developing a suitable customer offering, 3) Delivering the value 4) Communicating the value

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
27 h lectures, related discussions and group works, case exercise with both written and verbal part (62 h), case presentations (14 h) and independent reading of the textbooks and related material (20 h). During the course students will work in small groups and meet regularly in order to solve a marketing challenge proposed by the case company (case company is the same for all groups). Problem based learning (PBL) method will be applied and students play different roles to simulate tasks of the real life marketing professionals. Relating to these roles, students will write a learning diary (10 h). In the end of the course students will return a written report as a solution for the marketing challenge and presents it to other students.

Target group:

Students who are completing major/minor in marketing

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Kotler, P., Keller, K., Brady, M., Goodman, M. & Hansen, T. (2009 tai 2012) Marketing Management (1st or 2nd European Edition), Porter, M.E. (1985) Competitive Advantage and other material named by the lecturer.

Check availability from here.

Assessment methods and criteria:

Lectures and case exercise. The written part of the case exercise will determine 80% and the verbal part 20% of the grade. The assessment of the course unit is based on the learning outcomes of the course unit. Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1–5. In the numerical scale zero stands for a fail.

Person responsible:

Doctoral student Ilkka Ojansivu.

Working life cooperation:

-

Other information:

The number of students is limited.

721704P: Business Logistics, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Basic Studies
Laji: Course
Vastuuyksikkö: Oulu Business School
Arvostelu: 1 - 5, pass, fail
Opettajat: Jari Juga
Opintokohteen kielet: English
Leikkaavuudet:

  ay721704P   Business Logistics (OPEN UNI)   5.0 op
  721704A   Business Logistics   5.0 op

ECTS Credits:

 5 ECTS credits / 133 hours of work.

Language of instruction:

English.

Timing:

Autumn semester/ period B.

Learning outcomes:

The student recognizes how logistics contributes to business competitiveness and is able to specify central planning principles in logistics management. The student can describe interdependencies between logistics activities and solve basic problems in materials management and inventory control.

Contents:

Topics include logistics tradeoffs, logistics service level, transport and inventory management, logistics performance, basic production planning and order scheduling, just-in-time logistics, and green logistics.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures (30 h), including basic calculations and exercises in class. Independent reading of course literature (73 h) and self-study of calculation problems (30 h).

Target group:

Bachelor-level students.

Prerequisites and co-requisites:

-

Recommended optional programme components:

This study unit is also offered in the Open University (lectures in Finnish).

Recommended or required reading:

Jonsson, P. (2008), Logistics and Supply Chain Management, McGraw-Hill with supplementary study material in specified during lectures.

Check availability from here.

Assessment methods and criteria:

Exam (course book, lectures, basic calculation problems).
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Jari Juga.

Working life cooperation:

-

Other information:

-

721419P: Consumer Behavior, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Oulu Business School

Arvostelu: 1 - 5, pass, fail

Opettajat: Annu Perttunen

Opintokohteen oppimateriaali:
Assael, Henry , , 1995
Solomon, Michael R. , , 2004
Opintokohteen kielet: Finnish

Leikkaavuudet:

    ay721419P   Consumer Behavior (OPEN UNI)   5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5 ECTS credits / 133 hours of work

Language of instruction:

Finnish.

Timing:

Spring semester/ period D.

Learning outcomes:

Upon completion of the course, students have deepened their theoretical understanding of consumer behavior and internal and external factors affecting it. Students can apply different theories and conceptions to their business environment and evaluate the relevance and usefulness of such theories in their Master´s Thesis if needed.

Contents:

Lectures and related material include the following themes: 1) consumer decision-making process, 2) personality and attitude theories, 3) environmental impacts, 4) reference groups, 5) communication, and 6) different modes of consuming. Students will become familiar with scientific journals of consumer behavior.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

During the period D there will be 24 hours lectures and a group work (45 h). In addition, independent reading of the textbooks and related material for the exam (64 h).

Target group:

Students who are studying marketing as a major or minor subject.

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

Luentomateriaali sekä Solomon, M.R.: Consumer Behavior. Buying, having, being. 5. painos TAI Assael, H.: Consumer Behavior and Marketing Action. 1992.

Check availability from here.

Assessment methods and criteria:

Examination and exercise. The assessment of the course unit is based on the learning outcomes of the course unit.

Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Postdoctoral researcher Mari Juntunen.

Other information:

The number of students is limited.

A452288: Advanced module/Applied computing economy (optional), 20 - 40 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Module

Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional courses, module size approx. 35 credits

806109P: Basic Methods in Statistics I, 9 op

Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Jari Päkkilä
Opintokohteen oppimateriaali:
Grönroos, Matti (2) , , 2003
Heikkilä, Tarja , , 1998
Helenius, Hans , , 1989
Ranta, Esa (2) , , 1991
Wild, Christopher J. , , 2000
Opintokohteen kielet: Finnish
Leikkaavuudet:

806119P	A Second Course in Statistics	5.0 op
806116P	Statistics for Economic Sciences	5.0 op
806117P	Analysis of continuous response variable	5.0 op
ay806109P	Basic Methods in Statistics I (OPEN UNI)	9.0 op

ECTS Credits:

9 cr

Language of instruction:

Finnish

Timing:

The course is held in the spring semester, during periods III and IV.

Learning outcomes:

On successful completion of this course, the student will be able to
- use basic methods of collecting and describing data
- apply methods of statistical inference in some simple situations
- interpret listing of some statistical software

Contents:

Principles of collecting data and describing data with suitable tables, graphs and numerical measures are treated. The basic idea of estimation and statistical tests will be presented as well as some of the most common used confidence intervals and statistical tests. One aim is also to give basic knowledge from some statistical software.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

52 h lectures, 46 h exercises (including 10 h computer exercises), self-study.

Target group:

Minor student

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Lecture notes

Assessment methods and criteria:

Mid-term exams (2) or final exam.

Grading:

The course utilizes a numerical grading scale 1-5 / fail

Person responsible:

Jari Päkkilä

721672S: Economics of Network Industries, 6 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Oulu Business School
Arvostelu: 1 - 5, pass, fail
Opettajat: Timo Koivumäki
Opintokohteen kielet: Finnish

ECTS Credits:

6 ects.

Language of instruction:

Finnish.

Timing:

Period D.

Learning outcomes:

Upon completion of the course, students can understand the effects of the special characteristics (complementarity, consumption externalities, switching costs and lock in and economies of scale in production) on the market dynamics of network industries.

Contents:

We take a game theoretic approach to study dynamics of company structure, strategic decision-making and market development in network industries. We also focus on the effects of social interaction on consumers' choices.

Learning activities and teaching methods:

Lectures/ independent reading of the textbooks.

Recommended or required reading:

Shy (2001): Economics of Network Industries.

Check availability from here.

Assessment methods and criteria:

Exam.

Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5.

Person responsible:

Research Professor Timo Koivumäki.

Other information:

The number of students is limited.

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-6.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Timo Ojala.

Working life cooperation:

-

721462S: Business Networks, 6 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Oulu Business School
Arvostelu: 1 - 5, pass, fail
Opettajat: Satu Nätti
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

ECTS Credits:

6 ECTS credits / 160 hours of work

Language of instruction:

English.

Timing:

Period C

Learning outcomes:

Upon completion of the course, students have deepened their theoretical understanding of business networks. They are able to explain, why the different kinds of networks are important in global business life and how they are able to coordinate them considering strategic goals of the company. They can critically apply different network discourse conceptions to their global business environment. They are able to analyze the underlying logic of different types of strategic nets, learning and knowledge transfer within the global network likewise sources of conflict and conflict resolution strategies. After passing this course, students are capable to evaluate and argue the relevance and usefulness of such theories in their Master´s Thesis when needed.

Contents:

Lectures and related material include the following themes: 1) Principles of network thinking and basic concepts; 2) Networks and strategic thinking; 3) Different kind of strategic nets, their management mechanisms and capabilities needed (from subcontractor networks to development and innovation networks); 4) Learning and knowledge in the network context and 5) Sources of conflict in networks and conflict resolution.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Students have to attend the pre-exam (40 h). 36 hours lectures and related article analysis and mini cases, group work and related presentation (30 h), independent reading of the textbooks and related material for the exam (54 h).

Target group:

Master's level students in marketing.

Prerequisites and co-requisites:

In order to participate the course, a pre-exam should be passed (from book Håkansson, H. & Snehota, I eds: Developing Relationships in Business Networks, 1995). Detailed information on the pre-exam will be given on Noppa.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

The pre-exam: Developing Relationships in Business Networks (1995) Håkansson, H. & Snehota, I (eds.) (sections given by the lecturer before the course). The final exam: Lecture material AND Parolini, C. (1999) The Value Net – A Tool for Competitive Advantage.

Assessment methods and criteria:

Assessment will be at three stages. Pre-examination will determine 20% of the grade. The group work conducted during the course will determine 30% of the grade and the final exam 50% of the grade. The assessment of the course unit is based on the learning outcomes of the course unit.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Dr. Satu Nätti

Working life cooperation:

No

Other information:

The number of students is limited.

555344S: Management Information Systems, 5 op

Voimassaolo: - 31.07.2015

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Field of Industrial Engineering and Management

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

555314S   Management Information Systems   5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

4 ECTS credits.

Language of instruction:

English

Timing:

Periods 4-6.

Learning outcomes:

The aim of the course is to provide readiness for enterprise information system designing, purchasing, and development tasks. The aim is to familiarize a student with the significance of information and its management when controlling processes. After completing the course student can explain the key concepts of management information systems (MIS). The student can define the information needs of management processes and how information systems can meet these needs. The student can describe the key features of the following types of systems: DSS, GDSS, EIS, BI, and ERP. The student can analyse the state of the management in an organisation, and can suggest a suitable type of information system to support the management. After the course the student can take part in the organisational development from MIS viewpoints.

Contents:

Management information systems (MIS), information systems in decision making and leadership, Decision Support Systems (DSS), Group Support Systems (GSS), Executive Information Systems (EIS), the effects of information technology in operations, examining the effects of information and communication technology on productivity, financial growth, and the formation of national competitiveness.

Mode of delivery:

multiple methods available. The principal way to conduct the course is participate face-to-face teaching (that is held mainly in Finnish). Course is also given in English based on distance learning and closing session where the group work is represented.

Learning activities and teaching methods:

Lectures and independent work, or group work and seminar.

Target group:

Industrial engineering and management students.

Prerequisites and co-requisites:

B.Sc. in Industrial Engineering and Management or equivalent.

Recommended optional programme components:

-

Recommended or required reading:

Lecture materials and given set of journal articles. Laudon, K.C. & Laudon, J.P. 2004. Management Information systems. Prentice Hall. ISBN: 0-13-120681-8.

Assessment methods and criteria:

Learning diary (recommended when participating to the lectures), or group work report and seminar representation (recommended for exchange students), or exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5

Person responsible:

Professor Pekka Kess.

Working life cooperation:

No

Other information:

Compensatory course from 1.8.2015 is 555314S Management Information Systems.

A452281: Advanced Module/Embedded Systems, Embedded Systems Electronics (obligatory), 16 - 21 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Obligatory courses

521281S: Application Specific Signal Processors, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Boutellier, Jani Joosefi
Opintokohteen kielet: English

ECTS Credits:

5

Language of instruction:

In English.

Timing:

Spring, periods 4-5.

Learning outcomes:

Objective: The course introduces the main types of processors used in digital signal processing. Practical skills are learned by processor construction exercises.
Learning outcomes: After completing the course the student can distinguish the main types of signal processors and design a couple of transport triggered architecture processors. The student is able to assemble a signal processor out of basic entities and match the processor performance and the application requirements. The student applies the TTA codesign environment and Altera's FPGA tools to synthesize a system.

Contents:

Examples of modern signal processing applications, main types of signal processors, parallel signal processing, transport triggered architectures, algorithm-architecture matching, TCE design environment and Altera FPGA tools.

Mode of delivery:

Lectures, independent work, group work.

Learning activities and teaching methods:

Lectures 12h (participation mandatory); Instructed labs 12h ;Independent work 111h

Target group:

Computer Science and Engineering students + other Students of the University of Oulu. This is an advanced-level course intended for masters-level students and post-graduate students, especially to those who are specializing into signal pro-cessing.

Prerequisites and co-requisites:

521267A Computer engineering, 521337A digital filters, programming skills

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Handouts.

Assessment methods and criteria:

Participation in mandatory classes and approved project work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Jani Boutellier

Working life cooperation:

No.

521306A: Circuit Theory 2, 4 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Electrical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Rahkonen, Timo Erkki
Opintokohteen kielet: Finnish
Leikkaavuudet:

   521303A   Circuit Theory 2   5.0 op

ECTS Credits:

4

Language of instruction:

Finnish. Exams can be arranged in English on demand.

Timing:

Spring, periods 5-6

Learning outcomes:

After the course the student can
- use Laplace transform for solving time and frequency response of electric circuits
- derive continous-time transfer functions., solve their poles and zeros and understand the meaning of those
- draw the pole-zero map and Bode plots of any given transfer function
- construct 2-port parameter models of a given circuit

Contents:

Use of Laplace transform in network analysis. Properties of network functions, poles and zeros, Boden magnitude and phase plots. 2-port parameter models.

Mode of delivery:

Classroom

Learning activities and teaching methods:

30h lectures, 22 h exercises.

Target group:

Finnish BSc students.

Prerequisites and co-requisites:

Basics of circuit theory, differential equations.

Recommended optional programme components:

-

Recommended or required reading:

Nilsson, Riedel: Electric Circuits (6th or 7th ed., Prentice-Hall 1996), Chapters 12-18.

Assessment methods and criteria:

Course is examined by a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5

Person responsible:

Prof. Timo Rahkonen

Working life cooperation:

-

Other information:

-

521432A: Electronics Design I, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Electrical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ilkka Nissinen, Jan Nissinen
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

Finnish.

Timing:

Autumn, periods 1-3

Learning outcomes:

On completion of the study module students should be able to recount the principles covering the design of multistage amplifiers, analyze and set the frequency response of a transistor amplifier and make use of feedback to improve the properties of an amplifier in the desired manner. They should also be able to analyze the stability of a given degree of feedback amplification and to dimension an amplifier correctly to ensure stability. Students should similarly be able to describe the principles governing the design of power amplifiers, to make widespread use of operational amplifiers for realizing electronic circuits and to take account of the limitations imposed by the non-idealities inherent in operational amplifiers. They should be able to design low-frequency oscillators, to explain the operating principles of radio frequency oscillators and tuned amplifiers and to recount the basic principles governing the functions and properties of emitter-coupled logic.

Contents:

Frequency response of a transistor amplifier, differential amplifier, feedback, stability and nonidealities of a feedback amplifier, comparator, output stages and power amplifiers, applications of operational amplifier, oscillators, tuned amplifiers and ECL logic.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40 h and exercises 20 h.

Target group:

Not defined.

Prerequisites and co-requisites:

Principles of electronic design

Recommended optional programme components:

This course is required when participating in Laboratory Exercises on Analogue Electronics

Recommended or required reading:

Lecture notes, Razavi: Fundamentals of Microelectronics (John Wiley & Sons 2008), chapters 10-13-8 and 14, partially or Sedra & Smith : Microelectronic Circuits (6th ed.), chapters 7,8,9,13 and partially 11 and 12.

Assessment methods and criteria:

Final or 2 mid-term exams.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Ilkka Nissinen, Jan Nissinen

Working life cooperation:

-

Other information:

-

521445S: Digital Techniques 3, 6 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Electrical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Lahti

Opintokohteen kielet: Finnish

ECTS Credits:

6

Language of instruction:

In Finnish.

Timing:

Period 5-6

Learning outcomes:

After completing this course the student knows the phases of the design process of hardware parts of digital system implemented in FPGA or ASIC technologies, and understands their purpose, and the problems and aims associated with different design tasks. The student is also able to use the tools needed in industrial design projects.

Contents:

1. Digital systems design process. 2. System level design and modeling of digital systems. 3. Architecture level synthesis of digital circuits. 3. FPGA circuit design and verification (technology choice, logic synthesis, physical synthesis and timing analysis) 4, ASIC-design and verification (technology choice, logic synthesis, physical synthesis, timing analysis, power analysis, design for testability).

Mode of delivery:

Classroom

Learning activities and teaching methods:

Lectures 20h/ exercises 20h (group work)/independent work 120h.

Target group:

-

Prerequisites and co-requisites:

Digital techniques I + II

Recommended optional programme components:

-

Recommended or required reading:

Lecture textbook (in finnish) and literature announced during course.

Assessment methods and criteria:

Final exam or term exams, and a design excercise
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5, the grade is the average of the exam and the design exercise.

Person responsible:

Jukka Lahti

Working life cooperation:

-

Other information:

-

A452282: Advanced Module/Embedded Systems, Embedded Systems Electronics (optional), 14 - 39 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional courses, module size approx. 40 cr

521146S: Research Methods in Computer Science, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Vasileios Kostakos
Opintokohteen kielet: English
Leikkaavuudet:

    813621S   Research Methods   5.0 op

Timing:

Autumn, periods 2-3.

Learning outcomes:

Upon completing the course the student is able to explain the scientific method, create a research plan, design and conduct experimental studies for computer science, write in academic style, and give presentations.

Contents:

Scientific method, research planning, statistics, research tools, research methods, studying humans, academic writing, presentation skills.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

No prior courses are required.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete four individual activities throughout the semester: develop a research plan (20%), complete statistics tests (20%), generate graphs and figures (20%), conduct a mini experiment (40%). Passing criteria: all four elements (research plan, statistics tests, graphs and figures, mini experiment) must be completed, each receiving more than 50% of the available points.
Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Vassilis Kostakos

521405A: Electronic System Design, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kari Määttä

Opintokohteen kielet: Finnish

ECTS Credits:

5.0

Language of instruction:

Finnish.

Timing:

Periods 1-2.

Learning outcomes:

On completion of the study module a student is able to choose the optimum method of the choices presented in the course in the field of power supply, thermal design, grounding, and routing of the high speed signals. The student is able to calculate problems, caused by electrical disturbances, crosstalk and non-idealities of electrical components. After passing the course the student can calculate reliability of an electrical device or system.

Contents:

Power supplies, thermal design, grounding, transmission of fast signals by using transmission lines, electrical disturbances, crosstalk, non-idealities of electrical components, reliability of electronics.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

The course includes 30 h of lectures and 20 h of exercises.

Target group:

-

Prerequisites and co-requisites:

Both Principles of Electronics Design and Analogue Electronics I must have been accepted.

Recommended optional programme components:

-

Recommended or required reading:

Handout. Ward & Angus: Electronic Product Design, Hall&Hall&McCall: High speed Digital Design, Montrose: EMC and the Printed Circuit Board, Ott: Noise Reduction Techniques. Eric Bogatin: Signal and Power Integrity – Simplified, 2. ed.

Assessment methods and criteria:

Assessment methods and criteria: The course is passed by means of a final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 0 - 5. In the numerical scale 0 stands for a fail.

Person responsible:

Kari Määttä

Working life cooperation:

-

Other information:

-

521320S: Wireless Communications I, 8 op

Voimassaolo: 01.08.2007 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jari Iinatti

Opintokohteen kielet: English

Leikkaavuudet:

521395S	Wireless Communications I	5.0 op
521323S	Wireless Communications I	5.0 op

ECTS Credits:

8

Language of instruction:

English

Timing:

Fall, periods 1-3

Learning outcomes:

After completing the course the student can analyze the performance of multilevel digital modulation methods in AWGN channel. She/he can explain the effect of fading channel on the performance of the modulation method and can analyze the performance. She/he recognizes the suitable diversity methods for fading channel and related combining methods. Student can define the basic carrier and symbol synchronization methods and is able to make the performance comparison of them. Student can explain design methods signals for band-limited channels and can classify different channel equalizers, and perform the performance analysis. In addition, the student can utilize channel capacity evaluation for fading channels, he/she recognizes the basic methods for link adaptation and multi-antenna communication.

Contents:

Radio channel models, channel capacity, digital modulation method and their performance in AWGN-channel, carrier and symbol synchronization, performance of digital modulation in fading channel, diversity techniques, adaptive modulation and coding, multi-antenna techniques and channel equalizers in wireless communication.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40 h, exercises 20 h and the compulsory antenna design work with a simulation program (20 h)

Target group:

1 st year M.Sc. and WCE students

Prerequisites and co-requisites:

Telecommunication Engineering II, / Broadband communication systems

Recommended optional programme components:

Recommended **:** Statistical Signal Processing

Recommended or required reading:

Parts of book: Andrea Goldsmith: Wireless Communications, Cambridge University Press, 2005. Parts of J. G. Proakis: Digital Communications, 4th ed, McGraw Hill, 2001. Also, additional material from other sources.

Assessment methods and criteria:

The course is passed with final examination (during lecture periods possibility to pass with intermediate exams) and accepted design exercise. Grade is based on exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5.

Person responsible:

Jari Iinatti

Working life cooperation:

-

Other information:

Replaced by 521320S Wireless Communications I. Objective: Understanding of the basic theory and the knowledge of different fields required in digital communication are deepened. Also, communication techniques in fading channels are discussed. An overview of wireless communication systems is given, and ability to design simple communication receivers is created.

521443S: Electronics Design II, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Electrical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Juha Häkkinen
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

In Finnish (In English if needed).

Timing:

Autumn semester, periods 1-2

Learning outcomes:

On completion of the study module students should be able to explain the structures and operating principles of the passive and active (BJT and MOS) components available for use in modern IC technologies, analyze and design integrated electronic blocks based on these components, such as operational amplifiers, comparators and sampling circuits, and estimate and minimize the effects of noise on these. They should also be able to explain the terminology used with DA and AD conversion and converters and to analyze and outline their main architectural principles and also to evaluate their characteristics.

Contents:

Modeling of BJT and MOS transistors, CMOS and BJT building blocks especially as IC-realizations, noise and analysis of noise, internal structure of operational amplifiers, critical parameters, comparators, S/H-circuits, structures and properties of A/D and D/A converters.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Face-to-face teaching: Lectures 30h, exercises 20h. Self study: a small design work 20h. Learning without guidance either privately or in a group 60h.

Target group:

-

Prerequisites and co-requisites:

Principles of electronics design, Electronics design I

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes, D. A. Johns & K. Martin: Analog integrated circuit design, Wiley & Sons 1997, chapters 1, 3, 4, 5, 7, chapter 8 partially, 11, 12 and 13. OR P. E. Allen &D. R. Holberg: CMOS Analog Circuit Design, Oxford University Press 2002, chapters 1, 3, 4, 5, 6, 8 and 10.

Assessment methods and criteria:

The course unit is passed by a final exam and a passed design work.
Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5.

Person responsible:

Juha Häkkinen

Working life cooperation:

-

Other information:

-

521450S: Optoelectronics, 4 op

Voimassaolo: - 31.07.2014

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

4

Language of instruction:

Finnish.

Timing:

Period 5-6

Learning outcomes:

On completion of the study module students should be able to explain the principles of operation of photo conductors (optic fibers), semiconductor light sources and photo detectors used in optoelectronic measurements and telecommunications, paying due attention to factors affecting their performance. They should also be able to outline circuit-level structures for optical transmitter circuits and photo detector preamplifiers and to compare them in terms of their main performance parameters. They should also be reasonably able to use the main principles of signal processing principles that are typically used in optoelectronic measurement applications.

Contents:

Wave/particle dualism of optical radiation, optical waveguides and their properties, sources of radiation (radiation of black body, LED- and laser structures), photo detectors (photo conductive detector, photo multiplier, PIN- and AP-diodes, position sensitive detectors), light source modulation, preamplifiers and their bandwidth/stability/noise analysis, signal processing concepts used in optoelectronics.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h and exercises 20 h, may include a seminar.

Target group:

-

Prerequisites and co-requisites:

Principles of semiconductor devices.

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes, S. Kasap: Optoelectronics and Photonics, Principles and Practices, Prentice Hall 2001. J. Wilson, J. Hawkes, "Optoelectronics, an introduction", Prentice Hall, 3ed, ISBN 0-13-103961-X.

Assessment methods and criteria:

Final exam

Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5.

Person responsible:

Juha Kostamovaara

Working life cooperation:

-

Other information:

-

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-6.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

 A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Timo Ojala.

Working life cooperation:

-

521484A: Statistical Signal Processing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Heikkilä, Janne Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

   521348S   Statistical Signal Processing 1   5.0 op

ECTS Credits:

5

Language of instruction:

Finnish, Course can be passed in English.

Timing:

Spring, periods 4-6.

Learning outcomes:

Upon completion of the course, the student is able to utilize the generic linear model as a representation for parameter estimation. He can apply typical deterministic and random parameter estimation methods for different estimation problems. He is able to determine statistical properties of estimators and make comparisons between them. The student can also form a basic state-variable model and utilize Kalman filtering for state estimation. Moreover, he is able to apply basic methods of detection theory for solving simple detection problems. After the course, the student can implement the learned methods and assess their statistical properties with the Matlab software.

Contents:

This course provides basic knowledge of statistical signal processing, in particular, estimation theory and its applications in signal processing. Topics: 1. Introduction, 2. Modeling of estimation problems, 3. Least Squares estimation, 4. BLUE-estimation, 5. Signal detection, 6. ML estimation, 7. MS estimation, 8. MAP estimation, 9. Kalman Filter.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures (30 h), exercises (24 h) and Matlab design exercise (10 h). The rest as independent work.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

031019P Matrix Algebra, 031021P Probability and Mathematical Statistics

Recommended optional programme components:

521337A Digital Filters, 031050A Signal Analysis. These courses provide complementary information on digital signal processing and stochastic signals. The courses are recommended to be studied either in advance or simultaneously.

Recommended or required reading:

J. Mendel: Lectures in estimation theory for signal processing, communications and control, Prentice-Hall, 1995. M.D. Srinath, P.K. Rajasekaran, R. Viswanathan: Introduction to Statistical Signal Processing with Applications, Prentice-Hall, 1996, Chapter 3. Lecture notes and exercise material.

Assessment methods and criteria:

The course is passed with intermediate exams or final exam and accepted Matlab exercise.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Janne Heikkilä

Working life cooperation:

None.

521385S: Mobile Telecommunication Systems, 5 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Electrical Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Katz, Marcos Daniel
Opintokohteen kielet: English

ECTS Credits:

5

Language of instruction:

English

Timing:

Fall, periods 1-3

Learning outcomes:

Upon completing the required coursework, the student will be able to determine and fit the values of the main parameters for modern mobile telecommunication systems network planning. The course gives skills to describe mobility management, adaptive resource control and dynamic resource allocation in mobile networks.

Contents:

Concept and structures of modern mobile communications systems. Basics of radio network planning and capacity. Distributed transmission power control and mobility management. Resource allocation techniques: adaptive resource control, dynamic resource allocation. Cooperative communications. Examples of digital mobile telecommunication systems in practice.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30 h, exercises 16 h and the compulsory design work with a simulation program (16 h)

Target group:

2nd year M.Sc. and WCE students

Prerequisites and co-requisites:

Telecommunication Engineering II, Broadband Communications Systems and Wireless Communications I.

Recommended optional programme components:

-

Recommended or required reading:

The course material will be defined in the beginning of the course.

Assessment methods and criteria:

The course is passed with a final examination and the accepted simulation work report. Grade is based on the exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5.

Person responsible:

Marcos Katz

Working life cooperation:

-

Other information:

Objective: The goal of this course is to provide the basic understanding of dimensioning and performance of mobile communications systems. In addition, the current mobile communications system standards as well as the ones being developed are also studied, preparing students to understand the structure, functionality and dimensioning of these systems.

521331A: Filters, 4 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Rahkonen, Timo Erkki

Opintokohteen kielet: Finnish

Leikkaavuudet:

   521304A   Filters   5.0 op

ECTS Credits:

4

Language of instruction:

Finnish. Exams can be arranged in English on demand.

Timing:

Autumn, periods 3-4. Will be transferred to periods 4-6 in spring 2014.

Learning outcomes:

After the course the student can
- draw a pole-zero map for a given transfer function
- perform impedance and frequency scaling for component values
- choose an appropriate prototype filter and filter degree
- synthesize passive RLC filters
- synthesize active opamp based filters
- can compare various filter technologies

- understands the basics of scaling the dynamic range of active filters

Contents:

Filter types and prototypes, component scaling. Synthesis of active and passive filters. Sensitivity analysis and scaling of the dynamic range.

Mode of delivery:

Classroom

Learning activities and teaching methods:

25h lectures, 16 h exercises. A design excersice (15h).

Target group:

Finnish students

Prerequisites and co-requisites:

Basics of circuit theory and analog design.

Recommended optional programme components:

Course Digital filters expands the topic into digital domain.

Recommended or required reading:

Nilsson, Riedel: Electric Circuits (6th or 7th ed., Prentice-Hall 1996), Chapters 12-18.

Assessment methods and criteria:

Final exam. Also the simulation exercise must be passed.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5

Person responsible:

Prof. Timo Rahkonen

Working life cooperation:

-

Other information:

-

521369A: Simulations and Tools for Telecommunications, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Risto Vuohtoniemi

Opintokohteen kielet: Finnish

Leikkaavuudet:

   521328A   Simulations and Tools for Telecommunications   5.0 op

ECTS Credits:

3

Language of instruction:

Finnish

Timing:

Spring, periods 4-5

Learning outcomes:

A student recognizes problems and limitations related to simulations. A student can select a suitable simulation method and knows how to validate the model. Student knows how to generate signals, random numbers and noise as well as fading channels. A student knows how to make Monte-Carlo simulations at

the baseband level and can estimate confidence level of simulation results. A student can explain principles of network level simulations. Furthermore, a student knows basics of one or two fundamental simulation programs.

Contents:

Simulation methods, modelling communication systems with simulations, confidence limits of simulation, noise generation and modelling of fading channel. A simple baseband simulation example. Basics of MATLAB and OPNET simulation software (these could vary depending on needs/availability).

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 20 h (including program introductions), and the compulsory antenna design work with an electromagnetic simulation program (15 h).

Target group:

3 rd year bachelor's degree students

Prerequisites and co-requisites:

Telecommunication Engineering II

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes. Selected parts (informed in the notes) of Michel C. Jeruchim, Philip Balaban, and K. Sam Shanmugan, Simulation of Communication Systems, Modeling Methodology and Techniques, 2nd edition. Plenum Press, 2000. Additional reading: William H. Tranter, K. Sam Shanmugan, Theodore S. Rappaport, Kurt L. Kosbar, Principles of Communication Systems Simulation with Wireless Applications, Prentice Hall, 2004.

Assessment methods and criteria:

The course is passed with a final examination and the accepted simulation work report. The final grade is based on exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5.

Person responsible:

Risto Vuohtoniemi

Working life cooperation:

-

Other information:

-

A452283: Advanced Module/Embedded Systems, Embedded Systems Software (obligatory), 10 - 20 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

A452284: Advanced Module/Embedded Systems, Embedded Systems Software (optional), 23 - 35 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Module
Laji: Study module
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

Optional courses, module size approx. 40 cr

521146S: Research Methods in Computer Science, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Vasileios Kostakos
Opintokohteen kielet: English
Leikkaavuudet:

813621S	Research Methods	5.0 op

Timing:

Autumn, periods 2-3.

Learning outcomes:

Upon completing the course the student is able to explain the scientific method, create a research plan, design and conduct experimental studies for computer science, write in academic style, and give presentations.

Contents:

Scientific method, research planning, statistics, research tools, research methods, studying humans, academic writing, presentation skills.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

No prior courses are required.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete four individual activities throughout the semester: develop a research plan (20%), complete statistics tests (20%), generate graphs and figures (20%), conduct a mini experiment (40%). Passing criteria: all four elements (research plan, statistics tests, graphs and figures, mini experiment) must be completed, each receiving more than 50% of the available points.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Vassilis Kostakos

812346A: Object Oriented Analysis and Design, 6 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Information Processing Science
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

6 ECTS credits/160 hours of work

Language of instruction:

Finnish. If at least four non-Finnish student take the course, English exercises group is organised.

Timing:

2nd year, autum semester, period 1

Learning outcomes:

After completing the course, the students know possibilities of UML-language family to describe different views. They can picture a task using Use cases and scenarios. Moreover they can produce detailed descriptions using activity-, class-, interaction- and state diagrams. They know principles of object-orientedness and can use abstract as well interface classes. Additionally they can model user interface by state diagrams. They understand what design patterns are and how they are described and categorised.

Contents:

Principles of object orientation and object-oriented programming; quality criteria of object orientation; design patterns; case use; activity, class, interaction and state machine diagrams; class realisation.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 30h, compulsory exercises and assignments 28h, independent work 102h.

Prerequisites and co-requisites:

Basic knowledge of programming and information systems analysis and design.

Recommended optional programme components:

We recommend to take also the course Object-oriented programming (812347A).

Recommended or required reading:

Bennet, McRobb & Farmer: Object-oriented systems analysis and design, Using UML

Assessment methods and criteria:

Examination. At least 50% on points needed for passing the course.

Grading:

1-5

Person responsible:

Juha Iisakka

Working life cooperation:

No

812347A: Object-Oriented Programming, 6 op

Voimassaolo: - 31.07.2015

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Information Processing Science

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Vesanen

Opintokohteen kielet: Finnish

ECTS Credits:

6 ECTS credits/160 hours of work

Language of instruction:

Finnish

Timing:

2nd year, autumn semester, period 1

Learning outcomes:

After completing the course, the student is able to explain the general objectives and techniques of object-oriented programming paradigm. Furthermore, the student can describe the practical meaning of concepts of object-oriented programming. The student can construct C++ programs that apply inheritance, composition and polymorphism. Finally, the student is able to describe most common design patterns and to design and construct programs that contain the design patterns presented in the course.

Contents:

Introduction to object-orientation, basics of programming in C++ language, composition, inheritance and polymorphism, design patterns, generics, C++ standard template library and containers.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 32h, laboratory exercises 21h, weekly assignments and independent work 107h

Target group:

Prerequisites and co-requisites:

Courses "811192P Introduction to Programming in C", "811175P Programming Assignment" or similar knowledge.

Recommended optional programme components:

Recommended or required reading:

• Timothy Budd: Introduction to object-oriented programming, 3rd edition.
• Erich Gamma, Richard Helm, Ralph Johnson & John Vlissides: Design patterns – Elements of reusable object-oriented software.
• Bruce Eckel: Thinking in C++ Volume 1, 2nd edition.

Assessment methods and criteria:

Weekly assignments (preferred) or final exam + programming assignment
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5

Person responsible:

Ari Vesanen

Working life cooperation:

No

521320S: Wireless Communications I, 8 op

Voimassaolo: 01.08.2007 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Jari Iinatti

Opintokohteen kielet: English

Leikkaavuudet:

521395S	Wireless Communications I	5.0 op
521323S	Wireless Communications I	5.0 op

ECTS Credits:

8

Language of instruction:

English

Timing:

Fall, periods 1-3

Learning outcomes:

After completing the course the student can analyze the performance of multilevel digital modulation methods in AWGN channel. She/he can explain the effect of fading channel on the performance of the modulation method and can analyze the performance. She/he recognizes the suitable diversity methods for fading channel and related combining methods. Student can define the basic carrier and symbol synchronization methods and is able to make the performance comparison of them. Student can explain design methods signals for band-limited channels and can classify different channel equalizers, and perform the performance analysis. In addition, the student can utilize channel capacity evaluation for fading channels, he/she recognizes the basic methods for link adaptation and multi-antenna communication.

Contents:

Radio channel models, channel capacity, digital modulation method and their performance in AWGN-channel, carrier and symbol synchronization, performance of digital modulation in fading channel, diversity techniques, adaptive modulation and coding, multi-antenna techniques and channel equalizers in wireless communication.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 40 h, exercises 20 h and the compulsory antenna design work with a simulation program (20 h)

Target group:

1 st year M.Sc. and WCE students

Prerequisites and co-requisites:

Telecommunication Engineering II, / Broadband communication systems

Recommended optional programme components:

Recommended **:** Statistical Signal Processing

Recommended or required reading:

Parts of book: Andrea Goldsmith: Wireless Communications, Cambridge University Press, 2005. Parts of J. G. Proakis: Digital Communications, 4th ed, McGraw Hill, 2001. Also, additional material from other sources.

Assessment methods and criteria:

The course is passed with final examination (during lecture periods possibility to pass with intermediate exams) and accepted design exercise. Grade is based on exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5.

Person responsible:

Jari Iinatti

Working life cooperation:

-

Other information:

Replaced by 521320S Wireless Communications I. Objective: Understanding of the basic theory and the knowledge of different fields required in digital communication are deepened. Also, communication techniques in fading channels are discussed. An overview of wireless communication systems is given, and ability to design simple communication receivers is created.

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-6.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

 A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Timo Ojala.

Working life cooperation:

-

521281S: Application Specific Signal Processors, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Boutellier, Jani Joosefi
Opintokohteen kielet: English

ECTS Credits:

5

Language of instruction:

In English.

Timing:

Spring, periods 4-5.

Learning outcomes:

Objective: The course introduces the main types of processors used in digital signal processing. Practical skills are learned by processor construction exercises.
Learning outcomes: After completing the course the student can distinguish the main types of signal processors and design a couple of transport triggered architecture processors. The student is able to assemble a signal processor out of basic entities and match the processor performance and the application requirements. The student applies the TTA codesign environment and Altera's FPGA tools to synthesize a system.

Contents:

Examples of modern signal processing applications, main types of signal processors, parallel signal processing, transport triggered architectures, algorithm-architecture matching, TCE design environment and Altera FPGA tools.

Mode of delivery:

Lectures, independent work, group work.

Learning activities and teaching methods:

Lectures 12h (participation mandatory); Instructed labs 12h ;Independent work 111h

Target group:

Computer Science and Engineering students + other Students of the University of Oulu. This is an advanced-level course intended for masters-level students and post-graduate students, especially to those who are specializing into signal pro-cessing.

Prerequisites and co-requisites:

521267A Computer engineering, 521337A digital filters, programming skills

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Handouts.

Assessment methods and criteria:

Participation in mandatory classes and approved project work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical grading scale 1-5; zero stands for a fail.

Person responsible:

Jani Boutellier

Working life cooperation:

No.

521264S: Human-Computer Interaction Techniques, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

In English.

Timing:

Autumn, periods 2-3.

Learning outcomes:

Upon completing the course the student is able to explain the HCI fundamentals, explain evaluation and prototyping techniques, explain how HCI can be incorporated in the software development process.

Contents:

Human and computer fundamentals, design and prototyping, evaluation techniques, data collection and analysis.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

No prior courses are required.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete three group-based activities throughout the semester: design & prototyping (40%), conduct an evaluation (40%), and complete a report of the activities (20%). Passing criteria: all 3 elements (designs, evaluation, report) must be completed, each receiving more than 50% of the available points.
Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Vassilis Kostakos

Working life cooperation:

-

521369A: Simulations and Tools for Telecommunications, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Risto Vuohtoniemi

Opintokohteen kielet: Finnish

Leikkaavuudet:

521328A   Simulations and Tools for Telecommunications   5.0 op

ECTS Credits:

3

Language of instruction:

Finnish

Timing:

Spring, periods 4-5

Learning outcomes:

A student recognizes problems and limitations related to simulations. A student can select a suitable simulation method and knows how to validate the model. Student knows how to generate signals, random numbers and noise as well as fading channels. A student knows how to make Monte-Carlo simulations at the baseband level and can estimate confidence level of simulation results. A student can explain principles of network level simulations. Furthermore, a student knows basics of one or two fundamental simulation programs.

Contents:

Simulation methods, modelling communication systems with simulations, confidence limits of simulation, noise generation and modelling of fading channel. A simple baseband simulation example. Basics of MATLAB and OPNET simulation software (these could vary depending on needs/availability).

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 20 h (including program introductions), and the compulsory antenna design work with an electromagnetic simulation program (15 h).

Target group:

3 rd year bachelor's degree students

Prerequisites and co-requisites:

Telecommunication Engineering II

Recommended optional programme components:

-

Recommended or required reading:

Lecture notes. Selected parts (informed in the notes) of Michel C. Jeruchim, Philip Balaban, and K. Sam Shanmugan, Simulation of Communication Systems, Modeling Methodology and Techniques, 2nd edition. Plenum Press, 2000. Additional reading: William H. Tranter, K. Sam Shanmugan, Theodore S. Rappaport, Kurt L. Kosbar, Principles of Communication Systems Simulation with Wireless Applications, Prentice Hall, 2004.

Assessment methods and criteria:

The course is passed with a final examination and the accepted simulation work report. The final grade is based on exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5.

Person responsible:

Risto Vuohtoniemi

Working life cooperation:

-

Other information:

-

521013A: Advanced Practical Training, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kontinen, Jukka Pekka

Opintokohteen kielet: Finnish

Leikkaavuudet:

   521027S   Advanced practical training   5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
3
Language of instruction:
Finnish/English
Timing:
Whole academic year. Periods 1-6.
Learning outcomes:
After the advanced practical training the student can describe one possible future job, or another kind of position in an already familiar working environment. The student can identify problems in the working environment and solve them. The student can apply theoretical knowledge acquired in the studies to practical tasks. The student can identify roles of a diploma-engineer in the work place.
Contents:
Training in the research laboratories, development laboratories and process laboratories, among others, of the industry and institutions in the field of study. The technical goal of practical training is to give a general insight of the field in which the trainee will work after having taken the degree and to support and to promote theoretical studying. Likewise, the training has to acquaint the trainee with the social points of the industrial production and with industrial safety and has to give a sufficient picture of the technical details of the performing of different work. Furthermore, the training gives a general idea of the technical and economic organizing, administration and management of a company and its production.
Mode of delivery:
Independent work.

Learning activities and teaching methods:
Students find their training jobs themselves.
Target group:
Computer Science and Engineering MSc students.
Prerequisites and co-requisites:
None.
Recommended optional programme components:
-
Recommended or required reading:
None.
Assessment methods and criteria:
For the compulsory MSc stage practical training lasting at least two months a training report is required for which an acceptable grade must be obtained. A more exact compilation instruction of the training report is on the WWW pages of the degree programs.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail.
Person responsible:
Jukka Kontinen
Working life cooperation:
Yes.

521009S: The Maturity Test for Master`s Degree, 0 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

Ei opintojaksokuvauksia.

900013Y: Beginners' Finnish Course 1, 3 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

   ay900013Y   Beginners' Finnish Course 1 (OPEN UNI)   2.0 op

Proficiency level:
A1.2
Status:
-
Required proficiency level:
A1.1, Completion of the Survival Finnish course (900017Y) or the equivalent language skills.
ECTS Credits:
2 ECTS credits
Language of instruction:
As much Finnish as possible; English will be used as a help language.
Timing:
-
Learning outcomes:
By the end of the course the student can understand and use some familiar and common everyday expressions relating to her/himself and everyday situations. S/he can interact in a simple way provided the other person talks

slowly and clearly and is willing to help. The student is able to read short simple texts and messages dealing with familiar topics. S/he also deepens her/his understanding of the Finnish language and communication styles.
Contents:
This is lower elementary course which aims to help students to learn communication skills in ordinary everyday situations. During the course, students broaden their vocabulary and knowledge of grammar and principles of pronunciation. They also practise to understand easy Finnish talk about everyday subjects, and reading and writing short and simple texts/messages.

The topics and communicative situations covered in the course are: talking about oneself, one's family, studies and daily routines, as well as asking about these things from other person, expressing opinions, describing people and things, talking about weather and seasons, the names of the months and colours.

The structures studied are: verb types, basics of the change of the consonants k, p and t in verbs and nouns, the genitive and partitive cases, possessive structure, some declension types for nouns (word types) and the basics of the local cases.
Mode of delivery:
Contact teaching
Learning activities and teaching methods:
Lessons twicea week (24h) and self study (26 h).
Target group:
International degree and post-graduate degree students of the University.
Prerequisites and co-requisites:
Completion of the Survival Finnish Course
Recommended optional programme components:
-
Recommended or required reading:
Gehring, S. & Heinzmann, S. Suomen mestari 1 (chapters 3 - 5)
Assessment methods and criteria:
Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Grading scale is 1-5.
Person responsible:
Anne Koskela
Working life cooperation:
-
Other information:
Sign-up in WebOodi. The course will start right after the Survival Finnish course. The lessons will be held twice a week during a 6-week period.

900053Y: Beginners' Finnish Course 2, 5 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

   ay900053Y   Beginners' Finnish Course 2 (OPEN UNI)   4.0 op

Proficiency level:
A1.3
Status:
-
Required proficiency level:
A1.2, completion of the Beginners' Finnish course 1 (900013Y) or the equivalent language skills.
ECTS Credits:
4 ECTS credits
Language of instruction:
As much Finnish as possible; English will be used as a help language.

Timing:

-

Learning outcomes:

By the end of the course the student can understand and use some very common everyday expressions and sentences. S/he can communicate in easy and routine tasks requiring a simple and direct exchange of information on familiar everyday matters. The student understands different kinds of short texts. S/he can for example locate important information in them. In addition, s/he has acquired more detailed knowledge of the language and culture.

Contents:

This is a post-elementary course. During the course students learn more about communication in ordinary everyday situations in Finnish. They also extend their vocabulary and knowledge of grammar. Students practise understanding simple Finnish talk and short texts.

The topics and communicative situations covered in the course are: asking for and giving directions, asking for help /favours, carrying out transactions in shops and restaurants, talking about the past, asking for and expressing opinions and feelings, accommodation, travelling, vehicles, work, professions, food, drink and parties.

The structures studied are: the local cases, nominative plural (basic form plural), imperfect (past tense of verbs), part of the imperative, more declension types for nouns (word types), more about the change of the consonants k, p and t in verbs and nouns, declension of the demonstrative pronouns and personal pronouns, more about the partitive case, basics of the object cases, postpositions and some sentence types in Finnish.

Mode of delivery:

Contact teaching

Learning activities and teaching methods:

Lessons twice a week (50 h) and self study (50 h).

Target group:

International degree and post-graduate degree students of the University.

Prerequisites and co-requisites:

Completion of the Beginners' Finnish Course 1

Recommended optional programme components:

-

Recommended or required reading:

Gehring, S. & Heinzmann, S.: **Suomen mestari 1** (kappaleet 6-9)

Assessment methods and criteria:

Regular and active participation in the weekly lessons (twice a week), homework assignments and written midterm and final exams will be observed in assessment.

Read more about assessment criteria at the University of Oulu webpage.

Grading:

Grading scale is 1-5.

Person responsible:

Anne Koskela

Working life cooperation:

-

Other information:

Sign-up in WebOodi. The lessons will be held **twice a week** during a 13-week period.

900017Y: Survival Finnish, 2 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

  ay900017Y   Survival Finnish Course (OPEN UNI)   2.0 op

Proficiency level:

A1.1

Status:

-

Required proficiency level:

No previous Finnish studies.

ECTS Credits:
2 ECTS credits
Language of instruction:
Finnish and English
Timing:
-
Learning outcomes:
By the end of the course the student can understand and use some very common everyday expressions and phrases, and s/he can locate informational content in simple texts and messages. The student also knows the basic characteristics of Finnish language and Finnish communication styles.
Contents:
This is an introductory course which aims to help students to cope with the most common everyday situations in Finnish. During the course, students learn some useful everyday phrases, some general features of the vocabulary and grammar, and the main principles of pronunciation.

The topics and communicative situations covered in the course are: general information about the Finnish language, some politeness phrases (how to greet people, thank and apologize), introducing oneself, giving and asking for basic personal information, numbers, some time expressions (how to tell and ask the time, days of the week, time of day), food, drink and asking about prices.

The structures studied are: personal pronouns and their possessive forms, forming affirmative, negative and interrogative sentences, the conjugation of some verbs, the basics of the partitive singular and some local cases for answering the 'where'-question.
Mode of delivery:
Multi-modal teaching (Contact teaching, on-line teaching and independent work)
Learning activities and teaching methods:
Lessons twice a week (12 h) and self study (38 h).
Target group:
International degree and post-graduate degree students of the University.
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
Will be provided during the course.
Assessment methods and criteria:
Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Grading scale is 1-5.
Person responsible:
Anne Koskela
Working life cooperation:
-
Other information:
Sign-up in WebOodi. The lessons will be held once a week during a 6-week period.

521013A: Advanced Practical Training, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kontinen, Jukka Pekka

Opintokohteen kielet: Finnish

Leikkaavuudet:

   521027S   Advanced practical training   5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
3
Language of instruction:
Finnish/English
Timing:
Whole academic year. Periods 1-6.
Learning outcomes:
After the advanced practical training the student can describe one possible future job, or another kind of position in an already familiar working environment. The student can identify problems in the working environment and solve them. The student can apply theoretical knowledge acquired in the studies to practical tasks. The student can identify roles of a diploma-engineer in the work place.
Contents:
Training in the research laboratories, development laboratories and process laboratories, among others, of the industry and institutions in the field of study. The technical goal of practical training is to give a general insight of the field in which the trainee will work after having taken the degree and to support and to promote theoretical studying. Likewise, the training has to acquaint the trainee with the social points of the industrial production and with industrial safety and has to give a sufficient picture of the technical details of the performing of different work. Furthermore, the training gives a general idea of the technical and economic organizing, administration and management of a company and its production.
Mode of delivery:
Independent work.
Learning activities and teaching methods:
Students find their training jobs themselves.
Target group:
Computer Science and Engineering MSc students.
Prerequisites and co-requisites:
None.
Recommended optional programme components:
-
Recommended or required reading:
None.
Assessment methods and criteria:
For the compulsory MSc stage practical training lasting at least two months a training report is required for which an acceptable grade must be obtained. A more exact compilation instruction of the training report is on the WWW pages of the degree programs.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail.
Person responsible:
Jukka Kontinen
Working life cooperation:
Yes.

521149S: An introduction to computer vision methods for biomedical images (only for BME-SIP students), 5 - 8 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ojala, Timo Kullervo

Opintokohteen kielet: English

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
5-8
Language of instruction:
English; Finnish when only Finnish-speaking students.
Timing:
Autumn and Spring, periods 1-6.

Learning outcomes:
The learning outcomes are defined based on the course topic.
Contents:
Varies yearly.
Mode of delivery:
Face-to-face teaching, also web-based teaching can be used.
Learning activities and teaching methods:
Lectures, exercises, design exercise, project work and seminars depending on the topic of the year. The implementation of the course will be informed separately. The course can be given several times with different contents during the academic year and it can be included into the degree several times.
Target group:
M.Sc. level students of Computer Science and Engineering; other students are accepted if there is space in the classes.
Prerequisites and co-requisites:
Will be defined based on the contents.
Recommended optional programme components:
No.
Recommended or required reading:
Will be announced at the first lecture
Assessment methods and criteria:
Depends on the working methods.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
CSE dept. professors
Working life cooperation:
-

764664S: Analysis and simulation of biosystems, 6 op

Voimassaolo: 01.01.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

764364A   Analysis and simulation of biosystems   6.0 op

ECTS Credits:
6 credits
Language of instruction:
Finnish (or English)
Timing:
4th spring
Learning outcomes:
The student is able to use modelling in the analysis of simple biosystems, with the utilization of the concept of analogies between different types of systems. Further, with those skills the student will be able to build simulations of relatively simple biosystems and analyze their properties.
Contents:
See 764364A Analysis and simulation of biosystems
Assessment methods and criteria:
Read more about assessment criteria at the University of Oulu webpage.
Person responsible:
Matti Weckström, Iikka Salmela

041201A: Basics in eHealth, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Medicine

Arvostelu: 1 - 5, pass, fail

Opettajat: Jarmo Reponen

Opintokohteen kielet: English

Leikkaavuudet:

ay041201A   Basics in eHealth (OPEN UNI)   5.0 op

ECTS Credits:
5 ECTS
Language of instruction:
English
Timing:
2 nd year autumn
Learning outcomes:
The student can define central information and communication technological terms and solutions in healthcare, and can list respective applications in healthcare services and training.
The student can evaluate the societal and economical significance of information and communication technology in healthcare.
Contents:
- terms and concepts
- societal dimensions
- delivery of health services
- electronic patient records
- data transfer within the health care system
- data transfer between the health care professionals and the patients
- remote consultations, radiologypsychiatry
- economical and functional assessment
- remote education
- future visions of health care information systems
-
Mode of delivery:
Web-based teaching
Learning activities and teaching methods:
Interactivity takes place in virtual learning environment Optima. The course consists of video-taped lectures, power point-presentations and links to other material available in the web. Performance of duties includes an essay, exam, participating in discussions on the grounds of the lectures.
Target group:
Students of Medical Technology (medical and wellness technology, biophysics, other degree programs), Students of Health Sciences and information technology and everyone who is interested.
Recommended or required reading:
All recommended or required reading are offered in Optima virtual learning environment

Assessment methods and criteria:
Web tasks, essay and final exam.
Grading:
1-5
Person responsible:
Professor Jarmo Reponen
Other information:
Recommended literature
Graig J Wootton R, Patterson V (Eds): An introduction to
Telemedicine,RSM Press 2006
Saranto K, Korpela M (toim) Tietotekniikka ja tiedonhallinta sosiaali-
ja terveydenhuollossa, WSOY, Porvoo-Helsinki-Juva 1999
Hämäläinen P, Reponen J, Winblad I: eHealth of Finland,, Check point
2008, Report 1/2009 Gummerus. Jyväskylä 2009
(http://www.thl.fi/thl-client/pdfs/f5ca5a36-f2c6-4e94-ae95-a7b439b1169b
Winblad I, Reponen J, Hämäläinen P, Kangas M: Informaatio- ja
ommunikaatioteknologian käyttö Suomen terveydenhuollossa vuonna 2007.
Tilanne ja kehityksen suunta (English summary incl). Stakesin

raportteja 37/2008, Stakes, Helsinki 2008
http://www.stakes.fi/verkkojulkaisut/raportit/R37-2008-VERKKO.pdf
Journal of Telemedicine and Telecare
In addition: eLibrary in the Optima comprising updating of the topics of the lectures and some selected essays (by permission of the author)

580402S: Biomedical Imaging Methods, 1 - 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Simo Saarakkala

Opintokohteen kielet: English

ECTS Credits:
1-4 ECTS
Language of instruction:
English
Timing:
Master studies, spring. The course is not organized every year.
Learning outcomes:
The student knows and can describe the basic principles and main applications of imaging techniques used in biomedical research.
Contents:
Differences between in vivo, ex vivo and in vitro imaging. Optical in vivo imaging, optical tomography, magnetic resonance imaging, Fourier transform infrared microspectroscopy, Raman microspectroscopy, micro-computed tomography, basics of image analysis and interpretion.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures, demonstrations, practical exercise. Final exam.
Target group:
Master Students of Medical and Wellness technlogy and all other who are inerest in methods of biomedical imaging.
Recommended or required reading:
Required literature is given in the lectures.
Assessment methods and criteria:
Participation in the lectures and demonstrations, study diary. Exercises. Written exam.
The course can be taken as 1, 2 or 4 ECTS.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass or fail (1 or 2 ECTS), 1-5 (4ECTS).
Person responsible:
Associate Professor Simo Saarakkala
Working life cooperation:
No
Other information:
This course is a part of specialization of Biomedical Technology and Medical imaging.

521107S: Biomedical Instrumentation, 6 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

521093S   Biomedical Instrumentation   5.0 op

ECTS Credits:
6
Language of instruction:
English
Timing:
5-6
Learning outcomes:
After the course the student is capable to explain principles, applications and design of medical instruments most commonly used in hospitals. He/she can describe the electrical safety aspects of medical instruments and can present the physiological effects of electric current on humans. In addition the student is able to explain medical instrumentation development process and the factors affecting it. He/she also recognizes typical measurands and measuring spans and is able to plan and design a biosignal amplifier.
Contents:
Diagnostic instruments (common theories for medical devices, measurement quantities, sensors, amplifiers and registering instruments). Bioelectrical measurements (EKG, EEG, EMG, EOG, ERG), blood pressure and flow meters, respiration studies, measurements in a clinical laboratory, introduction to medical imaging methods and instruments, ear measurements, heart pacing and defibrillators, physical therapy devices, intensive care and operating room devices and electrical safety aspects.
Mode of delivery:
Face-to-face teaching.
Learning activities and teaching methods:
Lectures/exercises 54 h and self-study 100 h.
Target group:
Students interested in biomedical measurements.
Prerequisites and co-requisites:
None
Recommended optional programme components:
Course replaces course 521126S Biomedical measurements
Recommended or required reading:
R. S. Khandpur: Biomedical Instrumentation, Technology and Applications, McGraw-Hill, 2005 and J. G. Webster: Medical Instrumentation, Application and Design, 4th edition, John Wiley & Sons, 2010.
Assessment methods and criteria:
The course is passed by the final exam or optionally with the assignments/test agreed at the first lecture
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1-5
Person responsible:
Igor Meglinski
Working life cooperation:
None
Other information:
None.

521273S: Biosignal Processing, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tapio Seppänen

Opintokohteen kielet: Finnish

ECTS Credits:
5
Language of instruction:
Lectures are given in Finnish or in English. Laboratory work is given in Finnish and English. The examination can be taken in Finnish or English.
Timing:
Autumn, periods 2 and 3.
Learning outcomes:

After passing the course, student knows special characteristics of the biosignals and typical signal processing methods. Student can solve small-scale problems related to biosignal analysis.

Contents:
Biomedical signals. Digital filtering. Time-domain and frequency-domain analysis, Nonstationarity of biomedical signals. Event detection. Signal characterization.

Mode of delivery:
 Face-to-face teaching.
Learning activities and teaching methods:
Lectures 10 hours (5 times 2 hours) and laboratory work 20 hours (10 times 2 hours), the rest as independent work, written exam.

Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
The mathematical studies of the BSc of computer science and engineering or equivalent studies, digital filtering, programming skills.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
The course is based on the book "Biomedical Signal Analysis, A Case-Study Approach", R.M Rangayyan. 516 pages. + Lecture transparencies + Task assignment specific material.

Assessment methods and criteria:
Laboratory work is supervised by assistants who also check that the task assignments are completed properly. The course ends with a written exam.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Tapio Seppänen
Working life cooperation:
No.

521400S: CSE MasterŽs Thesis Seminar, 1 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Language of instruction:
English/Finnish
Timing:
Autumn and Spring, periods 1-6.
Learning outcomes:
After completing the course the student can prepare a presentation of predetermined length of her/his thesis and have experience on presenting the topic. In addition, she/he has experience on evaluating other students' presentations and has a general view of completed master's theses.
Contents:
The content is determined by the master's theses topics and other current research topics.
Mode of delivery:
Seminar presentations.
face-to-face teaching and Self-study.
Learning activities and teaching methods:

Face-to-face about 4 hours and independent work about 23 hours.
The student is required to participate in at least 4 seminars. In one of those, the student has to give an oral presentation of his/her diploma work. Presentations are given in English, and their length is approximately 30 minutes. Seminars are given during the whole year when necessary. The presentation is prepared independently and the amount of work is case-specific.
Target group:
Second year M.Sc. students of the CSE degree programme.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Instructions for preparing a master's thesis document in the CSE degree programme.
Assessment methods and criteria:
The student is required to participate in at least 4 seminars. In one of those, the student has to give an oral presentation of his/her diploma work. Presentations are given in English. Seminars are given during the whole year when necessary.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course uses verbal scale pass / fail.

521280S: DSP Laboratory Work, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Miguel Bordallo Lopez, Teemu Nyländen

Opintokohteen kielet: English

ECTS Credits:
5
Language of instruction:
In English.
Timing:
Periods 2-6 (it can be done from November to May).
Autumn and Spring.
Learning outcomes:
After the course the student is able to use integrated design environments of digital signal processors for designing, implementing and testing signal processing algorithms.
Contents:
Algorithm design, Sampling, quantization noise, signal generation, decimation and interpolation, FIR and IIR filter implementations, FFT implementations, DSP-assembly coding and optimization, Multi-rate signal processing, LMS adaptive filters implementations, CIC filtering.
Mode of delivery:
Starting lectures and independent exercises.
Learning activities and teaching methods:
The course is based on a starting lecture and exercises that are done using development boards of modern 32-bit digital signal processors, and the respective software development tools. The course is passed by accepted and documented exercises.
Target group:
Students interested in signal processing, processor architectures, embedded systems programming.
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
521337A Digital filters, 521267A Computer Engineering, programming skills.
Recommended optional programme components:
521279S Signal processing systems. This course provides complementary information on the DSP-laboratory Work course.
Recommended or required reading:
Exercise instruction booklet, processor handbooks and develop-ment environment handbooks. All material is in English.
Assessment methods and criteria:

The exercises will be passed or failed according to the functionality and overall quality.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale 1-5; zero stands for a fail.
Person responsible:
Miguel Bordallo López
Working life cooperation:
No.

521337A: Digital Filters, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannuksela, Jari Samuli

Opintokohteen kielet: Finnish

Leikkaavuudet:

   ay521337A   Digital Filters (OPEN UNI)   5.0 op

ECTS Credits:
5
Language of instruction:
Finnish, English study material available
Timing:
Spring, period 5-6.
Learning outcomes:
Upon completing the required coursework, the student is able to specify and design respective frequency selective FIR and IIR filters using the most common methods. He is also able to solve for the impulse and frequency responses of FIR and IIR filters given as difference equations, transfer functions, or realization diagrams, and can present analyses of the aliasing and imaging effects based on the responses of the filters. Moreover, the student is able to explain the impacts of finite word length in filter design. After the course the student has the necessary basic skills to use signal processing tools available in Matlab environment and to judge the results.

Contents:
1. Sampling theorem, aliasing and imaging, 2. Discrete Fourier transform, 3. Z-transform and frequency response, 4. Correlation and convolution, 5. Digital filter design, 6. FIR filter design and realizations, 7. IIR filter design and realizations, 8. Finite word length effects and analysis, 9. Multi-rate signal processing.

Mode of delivery:
Face-to-face teaching (Lectures), independent work, group work
Learning activities and teaching methods:
Lectures and exercises 50 h. The design exercises familiarize the students with the methods of digital signal processing using the Matlab software package. The rest as independent work.

Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
031018P Complex Analysis, 031050A Signal Analysis
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Lecture notes and exercise materials. Material is in Finnish and in English. Course book: Ifeachor, E., Jervis, B.: Digital Signal Processing, A Practical Approach, Second Edition, Prentice Hall, 2002.

Assessment methods and criteria:
The course can be passed either with week exams or a final exam. In addition, the exercises need to be returned and accepted.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Jari Hannuksela
Working life cooperation:
None.

521467A: Digital Image Processing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pietikäinen, Matti

Opintokohteen kielet: Finnish

Leikkaavuudet:

   ay521467A   Digital Image Processing (OPEN UNI)   5.0 op

ECTS Credits:
5
Language of instruction:
Lectures in Finnish and exercises in English. Course can be passed in Finnish and English.
Timing:
Autumn, periods 1-3.
Learning outcomes:
After completing the course the student understands the basic theory of digital image processing and knows its main applications. He is able to apply spatial and frequency domain and wavelet based methods in image enhancement, restoration, compression, segmentation and recognition.
Contents:
This course provides an introduction to digital image processing and machine vision. Topics: 1.Introduction, 2.Image enhancement, 3.Image restoration,
4. Color image processing, 5. Wavelets, 6. Image compression,7. Morphological image processing, 8. Image segmentation, 9. Representations and descriptions, 10. Pattern recognition.
Mode of delivery:
Face-to-face teaching.
Learning activities and teaching methods:
Lectures 25 h, exercises 7 h and Matlab design exercises 25 h. The rest as independent work.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
None.
Recommended optional programme components:
In order to obtain deep understanding of the content, it is a benefit if the student has completed the first year mathematic courses in the computer science and engineering BSc program or otherwise has equivalent knowledge.
Recommended or required reading:
Gonzalez, R.C., Woods, R.E.: Digital Image Processing, Second Edition, Addison-Wesley, 2002 (see course website: http://www.ee.oulu.fi/research/imag/courses/dkk/). Lecture notes and exercise material.
Assessment methods and criteria:
The course is passed by a final exam and programming exercises.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Matti Pietikäinen
Working life cooperation:
None.

521259S: Digital Video Processing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Heikkilä, Janne Tapani

Opintokohteen kielet: Finnish

ECTS Credits:
5
Language of instruction:
Finnish.
Timing:
Autumn, periods 2-3.
Learning outcomes:
In this course students become familiar with basics of video processing and communications. The emphasis is in video representation and coding.
After completing the course the student is able to explain the basic formats and representations of digital video signals. He can analyze the frequency properties of video signals as well as the effects of sampling of multi-dimensional signals, and he can specify digital filters for video sampling rate conversions. He is able to model video content by using simple two- and three-dimensional models, and apply certain well-known methods for video motion estimation. The student can explain the essential parts of the techniques used in video coding and the most important properties of common video coding standards. He can also describe the general principles of scalable video coding and error resilient video coding.
Contents:
1. Video formation, 2. Fourier analysis of video signals, 3. Sampling of multi-dimensional signals, 4. Video sampling rate conversion, 5. Video modeling, 6. Motion estimation, 7. Foundations of video coding, 8. Waveform-based coding, 9. Scalable video coding, 10. Video compression standards, 11. Error control in video communications.
Mode of delivery:
Face-to-face teaching.
Learning activities and teaching methods:
 Lectures (24 h), exercises (10 h) and Matlab design exercise (10 h). The rest as independent work.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
521467A Digital Image Processing, 521337A Digital Filters.
Recommended optional programme components:
521466S Machine Vision, 521488S Multimedia Systems. These courses provide complementary information on analysis and processing of digital video. The courses are recommended to be studied either in advance or simultaneously.
Recommended or required reading:
Y. Wang, J. Ostermann, Y. Zhang: Video processing and communications, Prentice-Hall, 2002, chapters 1-6, 8, 9, 11, 13, 14. Lecture notes and exercise material. All course material is in English.
Assessment methods and criteria:
The course is passed with final exam and accepted Matlab exercise.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Janne Heikkilä
Working life cooperation:
No.

521466S: Machine Vision, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Heikkilä, Janne Tapani

Opintokohteen kielet: Finnish

ECTS Credits:
5
Language of instruction:
In Finnish.
Timing:
Spring, periods 5-6.
Learning outcomes:
Upon completion of the course, the student can utilize common machine vision methods for various image analysis problems. He is able to carry out region segmentation and pattern recognition using color, texture and shape descriptors computed from images. He can use motion information in image analysis and model matching in image registration and object recognition. The student can explain the basics of geometric computer vision and is able to calibrate cameras as well as to obtain 3D coordinate measurements from the scene using for example stereo imaging. After the course the student has the rudimentary skills to use the Matlab environment and its tools for implementing machine vision methods and analyzing the results.
Contents:
1. Introduction, 2. Imaging and image representation, 3. Binary image analysis, 4. Pattern recognition concepts, 5. Color and shading, 6. Texture, 7. Content-based image retrieval, 8. Motion from 2D image sequences, 9. Image segmentation, 10. Matching in 2D, 11. Perceiving 3D from 2D images, 12. 3D models and matching.
Mode of delivery:
Face-to-face teaching.
Learning activities and teaching methods:
Lectures (30 h), exercises (15 h) and Matlab design exercise (10 h). The rest as independent work.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
521467A Digital Image Processing.
Recommended optional programme components:
521497S Pattern Recognition and Neural Networks. This course provides complementary information on pattern recognition and classification applied in machine vision. It is recommended to be studied simultaneously.
Recommended or required reading:
Shapiro L.G., Stockham G.C.: Computer vision, Prentice Hall, 2001. Lecture notes, exercise material. All course material is in English.
Assessment methods and criteria:
The course is passed with final exam and accepted Matlab exercise.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Janne Heikkilä
Working life cooperation:
No.

764634S: Medical physics and imaging, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
6 credits
Language of instruction:
English
Timing:
4th-5th Autumn
Learning outcomes:
The student is able to define the physical principles on which various medical diagnostic and therapeutic devices are based upon.

Contents:
The course acquaints the students to the basic physics related to imaging modalities and therapeutic systems used in hospitals. Covered topics include e.g. x-ray imaging, computed tomography, magnetic resonance imaging, nuclear medicine, radiation therapy and methods of clinical neurophysiology.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 32 h, calculus assignments 4 h, demonstrations 6 h, reporting 25 h, self-study 112 h
Target group:
Physics MSc students with biophysics major or/and medical physics minor, biomedical engineering students. Also for the other students of the University of Oulu.
Prerequisites and co-requisites:
Recommended: physics basic courses and Radiation physics, biology and safety (761116P, 764117P or 764317A).
Recommended optional programme components:
No alternative course units or course units that should be completed simultaneously
Recommended or required reading:
Dowsett, Kenny, Johnston: The Physics of Diagnostic Imaging, 2nd ed., Hodder Arnold, 2006.
Webster: Medical instrumentation: application and design, 4th ed, John Wiley & Sons, 2010.
Podgorsak: Radiation Oncology Physics – A handbook for teachers and students, IAEA, 2005 (http://www-pub.iaea. org/mtcd/publications/pdf/pub1196_web.pdf).

Additional literature depending on the lecturers.
Course material availability can be checked here.
Assessment methods and criteria:
One written examination
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale 0 – 5, where 0 = fail
Person responsible:
Miika Nieminen
Working life cooperation:
No work placement period
Other information:
https://wiki.oulu.fi/display/764634S/

521005P: Orientation Course for New CSE Students, 1 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

   521003P   Orientation Course for International CSE Students   1.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
1
Language of instruction:
Finnish. English when needed.
Timing:
Autumn, periods 1-3.
Learning outcomes:
After completing this course, students are familiar with academic studies and study-related services. Students know how to plan and schedule their studies based on their program curriculum. Students can use the necessary information and computer systems.
Contents:
Issues related to starting the studies. The university, student organizations, social services offered to students (such as financial aid, sports and health services). University of Oulu, Department of Computer Science and Engineering,

university administration. Degrees and studies in computer science and engineering, student exchange and PhD studies. Professional profile and current employment situation of the MSc in technology. Study planning and techniques, personal study plan (PSP). Introduction to the library and data services (Oula database). Department of Computer Science and Engineering website, Noppa, Lukkari and other information systems and tools, introduction to the use of work station.

Mode of delivery:
Fce-to-face teaching.

Learning activities and teaching methods:
Student tutoring, teacher tutoring, laboratory exercises on the use of work station, information sessions offered by the Faculty of Technology and degree program, independent work, total of 30 hours.

Target group:
First year BSc students in computer science and engineering

Prerequisites and co-requisites:
None.

Recommended optional programme components:
-

Recommended or required reading:
Study guidebook, websites

Assessment methods and criteria:
Participation in information sessions as well as student and teacher tutoring. Each student is required to submit a PSP for passing the course.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Pass/fail.

Person responsible:
Programme Director Jukka Riekki.

Working life cooperation:
None.

Other information:
-

521497S: Pattern Recognition and Neural Networks, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tapio Seppänen

Opintokohteen kielet: Finnish

Leikkaavuudet:

  521289S   Machine Learning   5.0 op

ECTS Credits:
5

Language of instruction:
Lectures are given in Finnish or in English. Programming exercises and calculation exercises are given in Finnish and English. The examination can be taken in Finnish or English.

Timing:
Spirng, periods 5 and 6.

Learning outcomes:
After completing the course the student can solve basic statistical calculation problems of pattern recognition and design simple optimal classifiers from the basic theory and assess their performance. The student can explain the Bayesian decision theory and apply it to derive minimum error classifiers and minimum cost classifiers. The student can apply the basics of gradient search method to design a linear discriminant function. In addition, (s)he can explain the structure and operating principle of some common neural networks.

Contents:
Introduction. Bayesian decision theory. Discriminant functions. Parametric and non-parametric classification. Feature extraction. Classifier design. Example classifiers. Neural networks like Perceptron and SOM.

Mode of delivery:

Face-to-face teaching.
Learning activities and teaching methods:
Introduction Lecture, Exercises 20 hours (10 times 2 hours), Programming Exercises 16 hours (8 times 2 hours), programming work compulsory, written exam.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
The mathematical studies of the BSc of computer science and engineering or equivalent studies, programming skills.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Duda RO, Hart PE, Stork DG, Pattern classification, John Wiley & Sons Inc., 2nd edition, 2001. Haykin S, Neural networks, MacMillan College Publishing Company, 1994 (or more recent). Handouts.
Assessment methods and criteria:
Programming work and calculation exercises are supervised by assistants who also check that the task assignments are completed properly. The course has a written exam.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Tapio Seppänen
Working life cooperation:
No.

521146S: Research Methods in Computer Science, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Vasileios Kostakos

Opintokohteen kielet: English

Leikkaavuudet:

   813621S   Research Methods   5.0 op

Timing:
Autumn, periods 2-3.
Learning outcomes:
Upon completing the course the student is able to explain the scientific method, create a research plan, design and conduct experimental studies for computer science, write in academic style, and give presentations.
Contents:
Scientific method, research planning, statistics, research tools, research methods, studying humans, academic writing, presentation skills.
Mode of delivery:
Face to face teaching.
Learning activities and teaching methods:
Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
No prior courses are required.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
All necessary material will be provided by the instructor.
Assessment methods and criteria:
The assessment is project-based. Students have to complete four individual activities throughout the semester: develop a research plan (20%), complete statistics tests (20%), generate graphs and figures (20%), conduct a mini

experiment (40%). Passing criteria: all four elements (research plan, statistics tests, graphs and figures, mini experiment) must be completed, each receiving more than 50% of the available points.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Vassilis Kostakos

521124S: Sensors and Measuring Techniques, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Matti Kinnunen, Myllylä, Risto Antero

Opintokohteen kielet: Finnish

ECTS Credits:
5
Language of instruction:
In Finnish. Materials also available in English.

Timing:
Periods 1-2.
Learning outcomes:
After the course the student is capable to explain the operating principles of different sensors and can select a right sensor for each measuring target. He/she is able to quantify the requirements that affect sensor selection as well as recognize and evaluate the uncertainty of a measurement. In addition the student is able to plan and design sensor signal conditioning circuits.
Contents:

Methods for measuring displacement, velocity, acceleration, torque, liquid level, pressure, flow, humidity, sound and temperature. Ultrasound, optical and

nuclear measurement techniques and applications, material analyses such as pH measurement and gas concentration, pulp and paper measurements and

smart sensors.

Mode of delivery:
Lectures and exercises.
Learning activities and teaching methods:
Lectures and exercises. The course is passed by a final exam.
Target group:
1st year MSc students.
Prerequisites and co-requisites:
Not defined.
Recommended optional programme components:
Not defined.
Recommended or required reading:
H. N. Norton: Handbook of Transducers, Prentice Hall P T R, 1989 or 2002; lecture notes (in Finnish); exercise notes (also in English)
Assessment methods and criteria:
The course is passed by a final exam.

Read more about assessment criteria at the University of Oulu webpage.
Grading:
1-5
Person responsible:
Matti Kinnunen
Working life cooperation:
None.
Other information:
None.

522987S: Master's Thesis in Biomedical Engineering, 30 op

Opiskelumuoto: Advanced Studies

Laji: Diploma thesis

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
30
Language of instruction:
English
Timing:
Second year of MSc
Learning outcomes:
The student knows the background and methods for the research field of his/her thesis, and is able to perform relatively large research project as well as to handle reporting of the results.
Contents:
Research project in the field of biomedical engineering and writing of the thesis.

Mode of delivery:
Face-to-face (supervision meetings)and independent work.
Learning activities and teaching methods:
Thesis can be made at different research groups of the university or in industry or health care system. The student writes the thesis independently supported by the supervisor. The topic and contents should be discussed with the professor beforehand.
Target group:
Second year MSc students (International Master's Degree Programme in Biomedical Engineering).
Prerequisites and co-requisites:
-
Recommended optional programme components:
No alternative course units or course units that should be completed simultaneously
Recommended or required reading:
-
Assessment methods and criteria:
Writing the thesis. Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale: 1 – 5
Person responsible:
Professor Tapio Seppänen
Working life cooperation:
Yes
Other information:
Detailed instructions:
http://www.oulu.fi/cse/studying/masters-thesis

521009S: The Maturity Test for Master`s Degree, 0 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

Ei opintojaksokuvauksia.

900013Y: Beginners' Finnish Course 1, 3 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay900013Y Beginners' Finnish Course 1 (OPEN UNI) 2.0 op

Proficiency level:
A1.2
Status:
-
Required proficiency level:
A1.1, Completion of the Survival Finnish course (900017Y) or the equivalent language skills.
ECTS Credits:
2 ECTS credits
Language of instruction:
As much Finnish as possible; English will be used as a help language.
Timing:
-
Learning outcomes:
By the end of the course the student can understand and use some familiar and common everyday expressions relating to her/himself and everyday situations. S/he can interact in a simple way provided the other person talks slowly and clearly and is willing to help. The student is able to read short simple texts and messages dealing with familiar topics. S/he also deepens her/his understanding of the Finnish language and communication styles.
Contents:
This is lower elementary course which aims to help students to learn communication skills in ordinary everyday situations. During the course, students broaden their vocabulary and knowledge of grammar and principles of pronunciation. They also practise to understand easy Finnish talk about everyday subjects, and reading and writing short and simple texts/messages.

The topics and communicative situations covered in the course are: talking about oneself, one's family, studies and daily routines, as well as asking about these things from other person, expressing opinions, describing people and things, talking about weather and seasons, the names of the months and colours.

The structures studied are: verb types, basics of the change of the consonants k, p and t in verbs and nouns, the genitive and partitive cases, possessive structure, some declension types for nouns (word types) and the basics of the local cases.
Mode of delivery:
Contact teaching
Learning activities and teaching methods:
Lessons twicea week (24h) and self study (26 h).
Target group:
International degree and post-graduate degree students of the University.
Prerequisites and co-requisites:
Completion of the Survival Finnish Course
Recommended optional programme components:
-
Recommended or required reading:
Gehring, S. & Heinzmann, S. Suomen mestari 1 (chapters 3 - 5)
Assessment methods and criteria:
Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Grading scale is 1-5.
Person responsible:
Anne Koskela
Working life cooperation:
-
Other information:

Sign-up in WebOodi. The course will start right after the Survival Finnish course. The lessons will be held twice a week during a 6-week period.

900053Y: Beginners' Finnish Course 2, 5 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

   ay900053Y   Beginners' Finnish Course 2 (OPEN UNI)   4.0 op

Proficiency level:
A1.3
Status:
-
Required proficiency level:
A1.2, completion of the Beginners' Finnish course 1 (900013Y) or the equivalent language skills.
ECTS Credits:
4 ECTS credits
Language of instruction:
As much Finnish as possible; English will be used as a help language.
Timing:
-
Learning outcomes:
By the end of the course the student can understand and use some very common everyday expressions and sentences. S/he can communicate in easy and routine tasks requiring a simple and direct exchange of information on familiar everyday matters. The student understands different kinds of short texts. S/he can for example locate important information in them. In addition, s/he has acquired more detailed knowledge of the language and culture.
Contents:
This is a post-elementary course. During the course students learn more about communication in ordinary everyday situations in Finnish. They also extend their vocabulary and knowledge of grammar. Students practise understanding simple Finnish talk and short texts.

The topics and communicative situations covered in the course are: asking for and giving directions, asking for help /favours, carrying out transactions in shops and restaurants, talking about the past, asking for and expressing opinions and feelings, accommodation, travelling, vehicles, work, professions, food, drink and parties.

The structures studied are: the local cases, nominative plural (basic form plural), imperfect (past tense of verbs), part of the imperative, more declension types for nouns (word types), more about the change of the consonants k, p and t in verbs and nouns, declension of the demonstrative pronouns and personal pronouns, more about the partitive case, basics of the object cases, postpositions and some sentence types in Finnish.
Mode of delivery:
Contact teaching
Learning activities and teaching methods:
Lessons twice a week (50 h) and self study (50 h).
Target group:
International degree and post-graduate degree students of the University.
Prerequisites and co-requisites:
Completion of the Beginners' Finnish Course 1
Recommended optional programme components:
-
Recommended or required reading:
Gehring, S. & Heinzmann, S.: **Suomen mestari 1** (kappaleet 6-9)
Assessment methods and criteria:
Regular and active participation in the weekly lessons (twice a week), homework assignments and written midterm and final exams will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Grading scale is 1-5.

Person responsible:
Anne Koskela
Working life cooperation:
-
Other information:
Sign-up in WebOodi. The lessons will be held **twice a week** during a 13-week period.

900017Y: Survival Finnish, 2 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

   ay900017Y   Survival Finnish Course (OPEN UNI)   2.0 op

Proficiency level:
A1.1
Status:
-
Required proficiency level:
No previous Finnish studies.
ECTS Credits:
2 ECTS credits
Language of instruction:
Finnish and English
Timing:
-
Learning outcomes:
By the end of the course the student can understand and use some very common everyday expressions and phrases, and s/he can locate informational content in simple texts and messages. The student also knows the basic characteristics of Finnish language and Finnish communication styles.
Contents:
This is an introductory course which aims to help students to cope with the most common everyday situations in Finnish. During the course, students learn some useful everyday phrases, some general features of the vocabulary and grammar, and the main principles of pronunciation.

The topics and communicative situations covered in the course are: general information about the Finnish language, some politeness phrases (how to greet people, thank and apologize), introducing oneself, giving and asking for basic personal information, numbers, some time expressions (how to tell and ask the time, days of the week, time of day), food, drink and asking about prices.

The structures studied are: personal pronouns and their possessive forms, forming affirmative, negative and interrogative sentences, the conjugation of some verbs, the basics of the partitive singular and some local cases for answering the 'where'-question.
Mode of delivery:
Multi-modal teaching (Contact teaching, on-line teaching and independent work)
Learning activities and teaching methods:
Lessons twice a week (12 h) and self study (38 h).
Target group:
International degree and post-graduate degree students of the University.
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
Will be provided during the course.
Assessment methods and criteria:
Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.

Read more about assessment criteria at the University of Oulu webpage.
Grading:
Grading scale is 1-5.
Person responsible:
Anne Koskela
Working life cooperation:
-
Other information:
Sign-up in WebOodi. The lessons will be held once a week during a 6-week period.

521013A: Advanced Practical Training, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Kontinen, Jukka Pekka

Opintokohteen kielet: Finnish

Leikkaavuudet:

   521027S   Advanced practical training   5.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
3
Language of instruction:
Finnish/English
Timing:
Whole academic year. Periods 1-6.
Learning outcomes:
After the advanced practical training the student can describe one possible future job, or another kind of position in an already familiar working environment. The student can identify problems in the working environment and solve them. The student can apply theoretical knowledge acquired in the studies to practical tasks. The student can identify roles of a diploma-engineer in the work place.
Contents:
Training in the research laboratories, development laboratories and process laboratories, among others, of the industry and institutions in the field of study. The technical goal of practical training is to give a general insight of the field in which the trainee will work after having taken the degree and to support and to promote theoretical studying. Likewise, the training has to acquaint the trainee with the social points of the industrial production and with industrial safety and has to give a sufficient picture of the technical details of the performing of different work. Furthermore, the training gives a general idea of the technical and economic organizing, administration and management of a company and its production.
Mode of delivery:
Independent work.
Learning activities and teaching methods:
Students find their training jobs themselves.
Target group:
Computer Science and Engineering MSc students.
Prerequisites and co-requisites:
None.
Recommended optional programme components:
-
Recommended or required reading:
None.
Assessment methods and criteria:
For the compulsory MSc stage practical training lasting at least two months a training report is required for which an acceptable grade must be obtained. A more exact compilation instruction of the training report is on the WWW pages of the degree programs.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail.

Person responsible:
Jukka Kontinen
Working life cooperation:
Yes.

521145A: Human-Computer Interaction, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Timing:
Autumn, periods 2-3
Learning outcomes:
Upon completing the course the student is able to explain the Human Computer Interaction (HCI) fundamentals, explain evaluation and prototyping techniques, explain how HCI can be incorporated in the software development process.
Contents:
Human and computer fundamentals, design and prototyping, evaluation techniques, data collection and analysis.
Mode of delivery:
Face to face teaching.
Learning activities and teaching methods:
Lectures (20 h), exercises (20 h), and practical work (95 h). The course is passed with an approved practical work. The implementation is fully English.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
None. No prior courses are required.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
All necessary material will be provided by the instructor.
Assessment methods and criteria:
The assessment is project-based. Students have to complete three group-based activities throughout the semester: design & prototyping (40%), conduct an evaluation (40%), and complete a report of the activities (20%). Passing criteria: all 3 elements (designs, evaluation, report) must be completed, each receiving more than 50% of the available points.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Vassilis Kostakos

521005P: Orientation Course for New CSE Students, 1 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

   521003P   Orientation Course for International CSE Students   1.0 op

Voidaan suorittaa useasti: Kyllä

ECTS Credits:
1
Language of instruction:
Finnish. English when needed.
Timing:
Autumn, periods 1-3.
Learning outcomes:
After completing this course, students are familiar with academic studies and study-related services. Students know how to plan and schedule their studies based on their program curriculum. Students can use the necessary information and computer systems.
Contents:
Issues related to starting the studies. The university, student organizations, social services offered to students (such as financial aid, sports and health services). University of Oulu, Department of Computer Science and Engineering, university administration. Degrees and studies in computer science and engineering, student exchange and PhD studies. Professional profile and current employment situation of the MSc in technology. Study planning and techniques, personal study plan (PSP). Introduction to the library and data services (Oula database). Department of Computer Science and Engineering website, Noppa, Lukkari and other information systems and tools, introduction to the use of work station.
Mode of delivery:
Fce-to-face teaching.
Learning activities and teaching methods:
Student tutoring, teacher tutoring, laboratory exercises on the use of work station, information sessions offered by the Faculty of Technology and degree program, independent work, total of 30 hours.
Target group:
First year BSc students in computer science and engineering
Prerequisites and co-requisites:
None.
Recommended optional programme components:
-
Recommended or required reading:
Study guidebook, websites
Assessment methods and criteria:
Participation in information sessions as well as student and teacher tutoring. Each student is required to submit a PSP for passing the course.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail.
Person responsible:
Programme Director Jukka Riekki.
Working life cooperation:
None.
Other information:
-

521260S: Programmable Web Project, 5 op

Voimassaolo: 01.08.2006 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Mika Rautiainen

Opintokohteen kielet: English

Leikkaavuudet:

   ay521260S   Programmable Web Project (OPEN UNI)   5.0 op

ECTS Credits:
5
Language of instruction:
In English.

Timing:
Spring, periods 4-6.
Learning outcomes:
Objective: The objective of the course is to supply the student with basic understanding of RESTful Web Services and related technologies.
Learning outcomes: Upon completing the required coursework, the student is able to design and implement different components of a RESTful Web Service including the Web client. The student becomes familiar with basic technologies to store data on the server, serialize data in the Web and to create Web based clients.
Contents:
RESTful Web Services, serialization languages (XML, JSON), data storage, HTML5 and AJAX.
Mode of delivery:
Web-based teaching and face-to-face teaching.
Learning activities and teaching methods:
Lectures 4 h, guided laboratory work 10 h, the rest as self-study and group work. Each group implements programs and writes a report.
Target group:
M.Sc. level students of Computer Science and Engineering; other students of the university of Oulu are accepted if there is space in the classes.
Prerequisites and co-requisites:
Elementary programming.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Will be announced at the first lecture.
Assessment methods and criteria:
This course unit utilizes continuous assessment. The students return each chapter of the project report separately and get from the teachers feedback to each chapter.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Mika Rautiainen
Working life cooperation:
None.
Other information:
This course replaces the course "521260S Representing structured information".

521146S: Research Methods in Computer Science, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Vasileios Kostakos
Opintokohteen kielet: English
Leikkaavuudet:

   813621S   Research Methods   5.0 op

Timing:
Autumn, periods 2-3.
Learning outcomes:
Upon completing the course the student is able to explain the scientific method, create a research plan, design and conduct experimental studies for computer science, write in academic style, and give presentations.
Contents:
Scientific method, research planning, statistics, research tools, research methods, studying humans, academic writing, presentation skills.
Mode of delivery:
Face to face teaching.
Learning activities and teaching methods:

Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:
Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:
No prior courses are required.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:
All necessary material will be provided by the instructor.

Assessment methods and criteria:
The assessment is project-based. Students have to complete four individual activities throughout the semester: develop a research plan (20%), complete statistics tests (20%), generate graphs and figures (20%), conduct a mini experiment (40%). Passing criteria: all four elements (research plan, statistics tests, graphs and figures, mini experiment) must be completed, each receiving more than 50% of the available points.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Vassilis Kostakos

521281S: Application Specific Signal Processors, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Boutellier, Jani Joosefi

Opintokohteen kielet: English

ECTS Credits:
5
Language of instruction:
In English.
Timing:
Spring, periods 4-5.
Learning outcomes:
Objective: The course introduces the main types of processors used in digital signal processing. Practical skills are learned by processor construction exercises.
Learning outcomes: After completing the course the student can distinguish the main types of signal processors and design a couple of transport triggered architecture processors. The student is able to assemble a signal processor out of basic entities and match the processor performance and the application requirements. The student applies the TTA codesign environment and Altera's FPGA tools to synthesize a system.
Contents:
Examples of modern signal processing applications, main types of signal processors, parallel signal processing, transport triggered architectures, algorithm-architecture matching, TCE design environment and Altera FPGA tools.
Mode of delivery:
Lectures, independent work, group work.
Learning activities and teaching methods:
Lectures 12h (participation mandatory); Instructed labs 12h ;Independent work 111h
Target group:
Computer Science and Engineering students + other Students of the University of Oulu. This is an advanced-level course intended for masters-level students and post-graduate students, especially to those who are specializing into signal pro-cessing.
Prerequisites and co-requisites:
521267A Computer engineering, 521337A digital filters, programming skills
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Handouts.

Assessment methods and criteria:
Participation in mandatory classes and approved project work.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale 1-5; zero stands for a fail.
Person responsible:
Jani Boutellier
Working life cooperation:
No.

521273S: Biosignal Processing, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tapio Seppänen

Opintokohteen kielet: Finnish

ECTS Credits:
5
Language of instruction:
Lectures are given in Finnish or in English. Laboratory work is given in Finnish and English. The examination can be taken in Finnish or English.
Timing:
Autumn, periods 2 and 3.
Learning outcomes:
After passing the course, student knows special characteristics of the biosignals and typical signal processing methods. Student can solve small-scale problems related to biosignal analysis.

Contents:
Biomedical signals. Digital filtering. Time-domain and frequency-domain analysis, Nonstationarity of biomedical signals. Event detection. Signal characterization.

Mode of delivery:
 Face-to-face teaching.
Learning activities and teaching methods:
Lectures 10 hours (5 times 2 hours) and laboratory work 20 hours (10 times 2 hours), the rest as independent work, written exam.

Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
The mathematical studies of the BSc of computer science and engineering or equivalent studies, digital filtering, programming skills.

Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
The course is based on the book "Biomedical Signal Analysis, A Case-Study Approach", R.M Rangayyan. 516 pages. + Lecture transparencies + Task assignment specific material.

Assessment methods and criteria:
Laboratory work is supervised by assistants who also check that the task assignments are completed properly. The course ends with a written exam.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:
Tapio Seppänen
Working life cooperation:
No.

521493S: Computer Graphics, 7 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Guoying Zhao

Opintokohteen kielet: English

Leikkaavuudet:

   521140S   Computer Graphics   5.0 op

ECTS Credits:
7
Language of instruction:
In English.
Timing:
Spring, periods 5-6.
Learning outcomes:
Upon completing the required coursework, student is able to specify and design 2D graphics algorithms including:
line and circle drawing, polygon filling and clipping, and 3D computer graphics algorithms including transformations,
viewing, hidden surface removal, shading, texture mapping and hierarchical modeling. Moreover, student is able to
explain the relationship between the 2D and 3D versions of such algorithms, and also has the necessary basic skills
to use these basic algorithms available in OpenGL.
Contents:
The history and evolution of computer graphics; 2D graphics including: line and circle drawing, polygon filling,
clipping, and 3D computer graphics algorithms including viewing transformations, shading, texture mapping and
hierarchical modeling; graphics API (OpenGL) for implementation.
Mode of delivery:
Face to face teaching.
Learning activities and teaching methods:
Lectures (40 hours) and self-study (50 h). In addition student will independently solve programming assignments (100
hours).
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
Pro-gramming skills using C++; basic data structures; simple linear algebra. Additionally recommended prerequisite
is the completion of the following course prior to enrolling for course unit: 521267A Computer Engineering.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
1) Textbook: Edward Angel: Interactive Computer Graphics, 5th, Addison-Wesley 2008
2) Reference: Peter Shirley, Michael Ashikhmin, Michael Gleicher, et al. : Fundamentals of Computer Graphics,
second edition, AK Peters, Ltd. 2005
3) Lecture notes (in English)
4) Materials in the internet (e.g. OpenGL redbook)
    • OpenGL Programming Guide or 'The Red Book':
http://unreal.srk.fer.hr/theredbook/
    • OpenGL Video Tutorial:
http://www.videotutorialsrock.com/opengl_tutorial/what_is_opengl/text.php
Assessment methods and criteria:
The assessment of the course is based on the exam (50%) and returned course work (50%).
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5; zero stands for a fail.
Person responsible:
Guoying Zhao, Jie Chen, Jukka Holappa

Working life cooperation:

-

A452291: Computer Vision and Signal Processing, advanced module, optionals, 10 - 20 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

optionals

521495A: Artificial Intelligence, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pietikäinen, Matti

Opintokohteen kielet: English

Leikkaavuudet:

ay521495A   Artificial Intellig (OPEN UNI)   5.0 op

ECTS Credits:

5

Language of instruction:

In Finnish. The exam and coursework can be passed in English.

Timing:

Periods 4-5.

Learning outcomes:

After taking the course, the student is able to identify the types of problems that can be solved using methods of artificial intelligence. The student knows the basic concepts of intelligent agents, the common search methods used in artificial intelligence, logic based reasoning and applying planning techniques to problems of artificial intelligence. The student can also apply simple methods to reasoning under uncertainty and machine learning from observation. In addition the student will be able to implement the most common search methods.

Contents:

1. Introduction, 2. Intelligent agents, 3. Solving problems by searching, 4. Informed search and exploration, 5. Constraint satisfaction problems, 6. Games, 7. Logical agents, 8. First-order logic, 9. Inference in first-order logic, 10. Planning, 11. Uncertainty, 12. Bayesian Networks, 13. Learning from observation.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

25 hours of lectures and a programming exercise (approximately 25 hours) during periods 4-5, the rest as independent work.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

Programming skills.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Primary text book and slides (in English): Russel S., Norvig P.: Artificial Intelligence, A Modern Approach (AIMA), Second Edition, Prentice Hall, 2003. Lecture notes (in Finnish): Syrjänen, M.: Tietämystekniikan peruskurssin luentomoniste, Teknillinen korkeakoulu, 2004. More details on the course WWW page http://www.ee.oulu.fi/research/imag/courses/ai/.

Assessment methods and criteria:

The course is passed with a final exam and a passed programming exercise.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5 / fail.

Person responsible:

Professor Matti Pietikäinen, 2013 Esa Rahtu.

Working life cooperation:

-

521337A: Digital Filters, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannuksela, Jari Samuli

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay521337A   Digital Filters (OPEN UNI)   5.0 op

ECTS Credits:

5

Language of instruction:

Finnish, English study material available

Timing:

Spring, period 5-6.

Learning outcomes:

Upon completing the required coursework, the student is able to specify and design respective frequency selective FIR and IIR filters using the most common methods. He is also able to solve for the impulse and frequency responses of FIR and IIR filters given as difference equations, transfer functions, or realization diagrams, and can present analyses of the aliasing and imaging effects based on the responses of the filters. Moreover, the student is able to explain the impacts of finite word length in filter design. After the course the student has the necessary basic skills to use signal processing tools available in Matlab environment and to judge the results.

Contents:

1. Sampling theorem, aliasing and imaging, 2. Discrete Fourier transform, 3. Z-transform and frequency response, 4. Correlation and convolution, 5. Digital filter design, 6. FIR filter design and realizations, 7. IIR filter design and realizations, 8. Finite word length effects and analysis, 9. Multi-rate signal processing.

Mode of delivery:

Face-to-face teaching (Lectures), independent work, group work

Learning activities and teaching methods:

Lectures and exercises 50 h. The design exercises familiarize the students with the methods of digital signal processing using the Matlab software package. The rest as independent work.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

031018P Complex Analysis, 031050A Signal Analysis

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Lecture notes and exercise materials. Material is in Finnish and in English. Course book: Ifeachor, E., Jervis, B.: Digital Signal Processing, A Practical Approach, Second Edition, Prentice Hall, 2002.

Assessment methods and criteria:

The course can be passed either with week exams or a final exam. In addition, the exercises need to be returned and accepted.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Jari Hannuksela

Working life cooperation:

None.

521484A: Statistical Signal Processing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Heikkilä, Janne Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

   521348S   Statistical Signal Processing 1   5.0 op

ECTS Credits:

5

Language of instruction:

Finnish, Course can be passed in English.

Timing:

Spring, periods 4-6.

Learning outcomes:

Upon completion of the course, the student is able to utilize the generic linear model as a representation for parameter estimation. He can apply typical deterministic and random parameter estimation methods for different estimation problems. He is able to determine statistical properties of estimators and make comparisons between them. The student can also form a basic state-variable model and utilize Kalman filtering for state estimation. Moreover, he is able to apply basic methods of detection theory for solving

simple detection problems. After the course, the student can implement the learned methods and assess their statistical properties with the Matlab software.

Contents:

This course provides basic knowledge of statistical signal processing, in particular, estimation theory and its applications in signal processing. Topics: 1. Introduction, 2. Modeling of estimation problems, 3. Least Squares estimation, 4. BLUE-estimation, 5. Signal detection, 6. ML estimation, 7. MS estimation, 8. MAP estimation, 9. Kalman Filter.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures (30 h), exercises (24 h) and Matlab design exercise (10 h). The rest as independent work.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

031019P Matrix Algebra, 031021P Probability and Mathematical Statistics

Recommended optional programme components:

521337A Digital Filters, 031050A Signal Analysis. These courses provide complementary information on digital signal processing and stochastic signals. The courses are recommended to be studied either in advance or simultaneously.

Recommended or required reading:

J. Mendel: Lectures in estimation theory for signal processing, communications and control, Prentice-Hall, 1995. M.D. Srinath, P.K. Rajasekaran, R. Viswanathan: Introduction to Statistical Signal Processing with Applications, Prentice-Hall, 1996, Chapter 3. Lecture notes and exercise material.

Assessment methods and criteria:

The course is passed with intermediate exams or final exam and accepted Matlab exercise.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Janne Heikkilä

Working life cooperation:

None.

521147S: Mobile and Social Computing, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Leikkaavuudet:

521046A	Mobile Computing	5.0 op
521045S	Mobile Computing	5.0 op

Language of instruction:

In English.

Timing:

Spring, periods 4-5

Learning outcomes:

Upon completing the course the student is able to implement mobile user interfaces, implement online social network applications, explain the fundamental concepts of context awareness and online communities.

Contents:

Mobile interface design and implementation, mobile sensor acquisition, context awareness, social platforms, crowdsourcing, online communities, graph theory.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

No prior courses are required.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete two group-based activities throughout the semester: build a mobile application (50%), build an online social application (50%). Passing criteria: both elements (mobile application, social application) must be completed, each receiving more than 50% of the available points.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

521467A: Digital Image Processing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Pietikäinen, Matti

Opintokohteen kielet: Finnish

Leikkaavuudet:

   ay521467A   Digital Image Processing (OPEN UNI)   5.0 op

ECTS Credits:

5

Language of instruction:

Lectures in Finnish and exercises in English. Course can be passed in Finnish and English.

Timing:

Autumn, periods 1-3.

Learning outcomes:

After completing the course the student understands the basic theory of digital image processing and knows its main applications. He is able to apply spatial and frequency domain and wavelet based methods in image enhancement, restoration, compression, segmentation and recognition.

Contents:

This course provides an introduction to digital image processing and machine vision. Topics: 1.Introduction, 2.Image enhancement, 3.Image restoration, 4. Color image processing, 5. Wavelets, 6. Image compression,7. Morphological image processing, 8. Image segmentation, 9. Representations and descriptions, 10. Pattern recognition.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Lectures 25 h, exercises 7 h and Matlab design exercises 25 h. The rest as independent work.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

None.

Recommended optional programme components:

In order to obtain deep understanding of the content, it is a benefit if the student has completed the first year mathematic courses in the computer science and engineering BSc program or otherwise has equivalent knowledge.

Recommended or required reading:

Gonzalez, R.C., Woods, R.E.: Digital Image Processing, Second Edition, Addison-Wesley, 2002 (see course website: http://www.ee.oulu.fi/research/imag/courses/dkk/). Lecture notes and exercise material.

Assessment methods and criteria:

The course is passed by a final exam and programming exercises.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Matti Pietikäinen

Working life cooperation:

None.

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-6.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

 A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Timo Ojala.

Working life cooperation:

-

521148S: Ubiquitous Computing Fundamentals, 5 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Language of instruction:

In English.

Timing:

Autumn, periods 2-3.

Learning outcomes:

Upon completing the course the student is able to apply the knowledge and methods provided in the course in the design, implementation and evaluation of ubiquitous computing systems.

Contents:

Ubiquitous computing systems, privacy, field studies, ethnography, interfaces, location, context-aware computing, processing sequential sensor data.

Mode of delivery:

Face-to-face.

Learning activities and teaching methods:

Lectures 18 h, exercises 18 h, project work 50 h, self-study 47 h. Exercises and project work are completed as group work.

Target group:

M.Sc. students (computer science and engineering) and other Students of the University of Oulu.

Prerequisites and co-requisites:

None.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Required literature: John Krumm (editor) Ubiquitous Computing Fundamentals, Chapman & Hall, 2010, ISBN 978-1-4200-9360-5, 328 pages; selected scientific publications.

Assessment methods and criteria:

The course is passed with an approved project work.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical scale 1-5; zero stands for a fail.

Person responsible:

Professor Timo Ojala.

Working life cooperation:

None.

521280S: DSP Laboratory Work, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Miguel Bordallo Lopez, Teemu Nyländen

Opintokohteen kielet: English

ECTS Credits:
5
Language of instruction:
In English.
Timing:
Periods 2-6 (it can be done from November to May).
Autumn and Spring.
Learning outcomes:
After the course the student is able to use integrated design environments of digital signal processors for designing, implementing and testing signal processing algorithms.
Contents:
Algorithm design, Sampling, quantization noise, signal generation, decimation and interpolation, FIR and IIR filter implementations, FFT implementations, DSP-assembly coding and optimization, Multi-rate signal processing, LMS adaptive filters implementations, CIC filtering.
Mode of delivery:
Starting lectures and independent exercises.
Learning activities and teaching methods:
The course is based on a starting lecture and exercises that are done using development boards of modern 32-bit digital signal processors, and the respective software development tools. The course is passed by accepted and documented exercises.
Target group:
Students interested in signal processing, processor architectures, embedded systems programming.

Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
521337A Digital filters, 521267A Computer Engineering, programming skills.
Recommended optional programme components:
521279S Signal processing systems. This course provides complementary information on the DSP-laboratory Work course.
Recommended or required reading:
Exercise instruction booklet, processor handbooks and develop-ment environment handbooks. All material is in English.
Assessment methods and criteria:
The exercises will be passed or failed according to the functionality and overall quality.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale 1-5; zero stands for a fail.
Person responsible:
Miguel Bordallo López
Working life cooperation:
No.

521259S: Digital Video Processing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Heikkilä, Janne Tapani

Opintokohteen kielet: Finnish

ECTS Credits:
5
Language of instruction:
Finnish.
Timing:
Autumn, periods 2-3.
Learning outcomes:
In this course students become familiar with basics of video processing and communications. The emphasis is in video representation and coding.
After completing the course the student is able to explain the basic formats and representations of digital video signals. He can analyze the frequency properties of video signals as well as the effects of sampling of multi-dimensional signals, and he can specify digital filters for video sampling rate conversions. He is able to model video content by using simple two- and three-dimensional models, and apply certain well-known methods for video motion estimation. The student can explain the essential parts of the techniques used in video coding and the most important properties of common video coding standards. He can also describe the general principles of scalable video coding and error resilient video coding.
Contents:
1. Video formation, 2. Fourier analysis of video signals, 3. Sampling of multi-dimensional signals, 4. Video sampling rate conversion, 5. Video modeling, 6. Motion estimation, 7. Foundations of video coding, 8. Waveform-based coding, 9. Scalable video coding, 10. Video compression standards, 11. Error control in video communications.
Mode of delivery:
Face-to-face teaching.
Learning activities and teaching methods:
 Lectures (24 h), exercises (10 h) and Matlab design exercise (10 h). The rest as independent work.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
521467A Digital Image Processing, 521337A Digital Filters.
Recommended optional programme components:
521466S Machine Vision, 521488S Multimedia Systems. These courses provide complementary information on analysis and processing of digital video. The courses are recommended to be studied either in advance or simultaneously.

Recommended or required reading:
Y. Wang, J. Ostermann, Y. Zhang: Video processing and communications, Prentice-Hall, 2002, chapters 1-6, 8, 9, 11, 13, 14. Lecture notes and exercise material. All course material is in English.
Assessment methods and criteria:
The course is passed with final exam and accepted Matlab exercise.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Janne Heikkilä
Working life cooperation:
No.

521321S: Elements of Information Theory and Coding, 5 op

Voimassaolo: 14.11.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Electrical Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Timo Kokkonen, Juntti, Markku Johannes

Opintokohteen kielet: English

Leikkaavuudet:

   521323S   Wireless Communications I   5.0 op

ECTS Credits:
5
Language of instruction:
In English.
Timing:
Fall, periods 1-3
Learning outcomes:
Upon completing the required coursework, the student is able to use the basic methodology of information theory to calculate the capacity bounds of communication and data compression systems. He can estimate the feasibility of given design tasks before the execution of the detailed design. What is more, she can independently search for information and knowledge related to communication engineering, system design and signal processing. The student understands the operating principles of block codes, cyclic codes and convolutional codes. He can form an encoder and decoder for common binary block codes, and is capable of using tables of the codes and shift register when solving problems. She can represent the operating idea of a convolutional encoder as a state machine, the student is able to apply the Viterbi algorithm to decoding of convolutional codes, and is capable of specifying principles of turbo coding and coded modulation. Moreover, he can evaluate error probability of codes and knows practical solutions of codes by name.
Contents:
Entropy, mutual information, data compression, basics of source coding, discrete channels and their capacity, the Gaussian channel and its capacity, rate distortion theory, introduction to network information theory, block codes, cyclic codes, burst error correcting codes, error correcting capability of block codes, convolutional codes, Viterbi algorithm, concatenated codes, and introduction to turbo coding and to coded modulation.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 40 h, exercises 20 h
Target group:
1 st year M.Sc. and WCE students
Prerequisites and co-requisites:
Signal Analysis, Telecommunication Engineering II
Recommended optional programme components:
Wireless Communications I
Recommended or required reading:
Parts from books Thomas M. Cover & Joy A. Thomas: Elements of Information Theory, 2nd ed. John Wiley & Sons, 2006 ISBN-13 978-0-471-24195-9, ISBN-10 0-471-24195-4, and S. Benedetto and E. Biglieri: Principles of Digital

Transmission with Wireless Applications, 1999, Chapters 3, 10 and in part 11 and 12. Lecture notes and other literature.
Assessment methods and criteria:
The course is passed with weekly exams (only during lecture periods) or with final exam.
Grading:
The course unit utilizes a numerical grading scale 1-5.
Read more about assessment criteria at the University of Oulu webpage.
Person responsible:
Markku Juntti / Timo Kokkonen
Working life cooperation:
-
Other information:
-

031025A: Introduction to Optimization, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Ruotsalainen Keijo

Opintokohteen kielet: English

ECTS Credits:
5
Language of instruction:
English
Timing:
Fall semester, periods 1-2
Learning outcomes:
After completing the course the student is able to solve optimization convex optimization problems with the basic optimization algorithms. The student is also able to form the necessary and sufficient conditions for the optimality.
Contents:
Linear optimization, Simplex-algorithm, nonlinear optimization, KKT-conditions, duality, conjugate gradient method, penalty and barrier function methods.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 40 h / Group work 20 h.
Target group:
Students in Wireless Communication Engineering
Prerequisites and co-requisites:
The recommended prerequisite is the completion of the courses Calculus I and II, Matrix algebra
Recommended optional programme components:
-
Recommended or required reading:
P. Ciarlet; Introduction to numerical linear algebra and optimization, M. Bazaraa, H. Sherali, C.M. Shetty; Nonlinear programming
Assessment methods and criteria:
Intermediate exams or a final exam.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale 1-5.
Person responsible:
Keijo Ruotsalainen
Working life cooperation:
-
Other information:
-

521466S: Machine Vision, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Heikkilä, Janne Tapani

Opintokohteen kielet: Finnish

ECTS Credits:
5
Language of instruction:
In Finnish.
Timing:
Spring, periods 5-6.
Learning outcomes:
Upon completion of the course, the student can utilize common machine vision methods for various image analysis problems. He is able to carry out region segmentation and pattern recognition using color, texture and shape descriptors computed from images. He can use motion information in image analysis and model matching in image registration and object recognition. The student can explain the basics of geometric computer vision and is able to calibrate cameras as well as to obtain 3D coordinate measurements from the scene using for example stereo imaging. After the course the student has the rudimentary skills to use the Matlab environment and its tools for implementing machine vision methods and analyzing the results.
Contents:
1. Introduction, 2. Imaging and image representation, 3. Binary image analysis, 4. Pattern recognition concepts, 5. Color and shading, 6. Texture, 7. Content-based image retrieval, 8. Motion from 2D image sequences, 9. Image segmentation, 10. Matching in 2D, 11. Perceiving 3D from 2D images, 12. 3D models and matching.
Mode of delivery:
Face-to-face teaching.
Learning activities and teaching methods:
Lectures (30 h), exercises (15 h) and Matlab design exercise (10 h). The rest as independent work.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
521467A Digital Image Processing.
Recommended optional programme components:
521497S Pattern Recognition and Neural Networks. This course provides complementary information on pattern recognition and classification applied in machine vision. It is recommended to be studied simultaneously.
Recommended or required reading:
Shapiro L.G., Stockham G.C.: Computer vision, Prentice Hall, 2001. Lecture notes, exercise material. All course material is in English.
Assessment methods and criteria:
The course is passed with final exam and accepted Matlab exercise.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Janne Heikkilä
Working life cooperation:
No.

521497S: Pattern Recognition and Neural Networks, 5 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Tapio Seppänen

Opintokohteen kielet: Finnish

Leikkaavuudet:

521289S   Machine Learning   5.0 op

ECTS Credits:
5
Language of instruction:
Lectures are given in Finnish or in English. Programming exercises and calculation exercises are given in Finnish and English. The examination can be taken in Finnish or English.
Timing:
Spirng, periods 5 and 6.
Learning outcomes:
After completing the course the student can solve basic statistical calculation problems of pattern recognition and design simple optimal classifiers from the basic theory and assess their performance. The student can explain the Bayesian decision theory and apply it to derive minimum error classifiers and minimum cost classifiers. The student can apply the basics of gradient search method to design a linear discriminant function. In addition, (s)he can explain the structure and operating principle of some common neural networks.
Contents:
Introduction. Bayesian decision theory. Discriminant functions. Parametric and non-parametric classification. Feature extraction. Classifier design. Example classifiers. Neural networks like Perceptron and SOM.
Mode of delivery:
Face-to-face teaching.
Learning activities and teaching methods:
Introduction Lecture, Exercises 20 hours (10 times 2 hours), Programming Exercises 16 hours (8 times 2 hours), programming work compulsory, written exam.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
The mathematical studies of the BSc of computer science and engineering or equivalent studies, programming skills.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Duda RO, Hart PE, Stork DG, Pattern classification, John Wiley & Sons Inc., 2nd edition, 2001. Haykin S, Neural networks, MacMillan College Publishing Company, 1994 (or more recent). Handouts.
Assessment methods and criteria:
Programming work and calculation exercises are supervised by assistants who also check that the task assignments are completed properly. The course has a written exam.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Tapio Seppänen
Working life cooperation:
No.

521279S: Signal Processing Systems, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Hannuksela, Jari Samuli

Opintokohteen kielet: Finnish

ECTS Credits:
5
Language of instruction:
English
Timing:
Autumn, periods 1-3.
Learning outcomes:

After the course the student can explain the challenges of signal processing hardware, software, and design methodologies. He is able to transform a digital filter designed with floating point arithmetic into a fixed point precision implementation, optimizing the word lengths to achieve the performance specifications. In addition, the student is able to explain the most important algorithm implementation structures and can identify their usage contexts. After the course the student has rudimentary practical skills in modeling, designing, and judging finite word length signal processing algorithms with Matlab and Simulink software tools.

Contents:
Binary and floating point arithmetic, DSP programming models and co-design, digital signal processors, algorithms and implementations, including CORDIC, transforms (FFT and DCT), multi-rate signal processing, polyphase filters, filter banks, adaptive algorithms and applications. The software environments of the course are Matlab with the Fixed Point Toolbox extension and Simulink with the DSP Blockset extension.
Mode of delivery:
Lectures, independent work, group work.
Learning activities and teaching methods:
The course consists of lectures (30 h) and design exercises (6-12 h). the rest as independent work (33h).
Target group:
Computer Science and Engineering students: This is an advanced-level course intended for masters-level students, especially to those that are specializing into signal processing.
+ other Students of the University of Oulu.
Prerequisites and co-requisites:
521337A Digital Filters, 521267A Computer Engineering
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
 Lecture notes and exercise materials. Material is in English.
Assessment methods and criteria:
Final exam and approved design exercises.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Jari Hannuksela
Working life cooperation:
No.

521151A: Applied Computing Project I, 10 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Vasileios Kostakos, Ojala, Timo Kullervo

Opintokohteen kielet: English

Leikkaavuudet:

   521041A   Applied Computing Project I   8.0 op

Language of instruction:
In English.
Timing:
Autumn and spring, periods 1-6.
Learning outcomes:
Upon completing the course the student is able to complete a full cycle of interactive systems development, including requirements elicitation, system design, prototyping, testing, and evaluation. In this work, the student is able apply skills obtained in B.Sc. courses.
Contents:
Project work.
Mode of delivery:
Face to face teaching, project work as collaborative team work.

Learning activities and teaching methods:
Practical work in project teams. The course is passed with an approved project work. The implementation is fully English.
Target group:
3rd year Computer Science and Engineering B.Sc. students and other Students of the University of Oulu.
Prerequisites and co-requisites:
No prior courses are required.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Dix, Finlay, Abowd & Beale: Human-Computer Interaction (http://www.hcibook.com); Rogers, Sharp & Preece: Interaction Design: Beyond Human-Computer Interaction (http://www.id-book.com).
Assessment methods and criteria:
The course uses continuous assessment so that the project work is assessed in stages: design (20% of total grade), implementation (40%), evaluation (20%), and final report (20%). Passing criteria: all stages (design, implementation, evaluation, report) must be completed with an approved grade.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical grading scale 1-5; zero stands for a fail.
Person responsible:
Vassilis Kostakos, Timo Ojala.

521152S: Applied Computing Project II, 10 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ojala, Timo Kullervo, Vasileios Kostakos

Opintokohteen kielet: English

ECTS Credits:
10
Language of instruction:
In English.
Timing:
Autumn and Spring, periods 1-6.
Learning outcomes:
Upon completing the course the student is able to complete a full cycle of interactive systems development, including requirements elicitation, system design, prototyping, testing, and evaluation. In this work, the student is able apply skills obtained in other courses.
Contents:
Project work.
Mode of delivery:
Face to face teaching, project work as collaborative team work.
Learning activities and teaching methods:
Practical work in project teams. The course is passed with an approved project work. The implementation is fully English.
Target group:
Computer Science and Engineering M.Sc. students and other Students of the University of Oulu.
Prerequisites and co-requisites:
No prior courses are required.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Dix, Finlay, Abowd & Beale: Human-Computer Interaction (http://www.hcibook.com); Rogers, Sharp & Preece: Interaction Design: Beyond Human-Computer Interaction (http://www.id-book.com).
Assessment methods and criteria:

The course uses continuous assessment so that the project work is assessed in stages: design (20% of total grade), implementation (40%), evaluation (20%), and final report (20%). Passing criteria: all stages (design, implementation, evaluation, report) must be completed with an approved grade.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
Vassilis Kostakos, Timo Ojala.

521266S: Distributed Systems, 6 op

Voimassaolo: 01.08.2005 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Ojala, Timo Kullervo

Opintokohteen kielet: English

Leikkaavuudet:

521290S	Distributed Systems	5.0 op

Language of instruction:
In English.
Timing:
Spring, periods 4-5.
Learning outcomes:
Upon completing the course the student is able to explain the key principles of distributed systems, apply them in evaluating the major design paradigms used in implementing distributed systems, solve distributed systems related problems, and design and implement a small distributed system.
Contents:
Architectures, processes, com-munication, naming, synchronization, consistency and replication, fault tolerance, security, distributed object-based systems, distributed file systems, distributed web-based systems, distributed coordination-based systems.
Mode of delivery:
Face-to-face.
Learning activities and teaching methods:
Lectures 30 h, exercises 26 h, project work 50 h, self-study 54 h. Project work is completed as group work.
Target group:
M.Sc. students (computer science and engineering) and other Students of the University of Oulu.
Prerequisites and co-requisites:
None.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Required literature: Andrew S. Tanenbaum and Maarten van Steen, Distributed Systems – Principles and Paradigms, Second Edition, Prentice Hall, 2007, ISBN 978-0132392273, 704 pages.
Assessment methods and criteria:
The course uses continuous assessment so that there are 3 intermediate exams. Alternatively, the course can also be passed with a final exam. The course includes a mandatory project work.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Numerical scale 1-5; zero stands for a fail.
Person responsible:
Professor Timo Ojala
Working life cooperation:
None.

812335A: Interaction Design, 4 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Information Processing Science

Arvostelu: 1 - 5, pass, fail

Opettajat: Netta Iivari, Anna-Liisa Syrjänen

Opintokohteen kielet: English

ECTS Credits:
4 ECTS credits/108 hours of work
Language of instruction:
English
Timing:
1st year of Master's studies, autumn semester period 2
Learning outcomes:
Objective: The course explains the role of human interaction with products and services, explains the factors and problems related to it to motivate interaction design, and teaches some methods for analysis, evaluation and design of interactions.
Learning Outcomes: After completing the course, the student can assess the role of human interaction with information technological products or services and identify factors and problems related to it within a practical design case. The student is able to:
   • use methods for analysis and evaluation of existing interfaces;
   • understand the role of requirements, plan and conduct a simple requirements collection and analysis;
   • use basic principles of usability for graphical user interface design;
   • use interaction design methods to create a novel or redesigned interactive product.
Contents:
The first part provides an overview of interaction design, introducing the key issues and activities of the subject: the terminology and fundamental concepts of the area; the main activities involved in interaction design, and the importance of user involvement in the design process. Part two addresses the key activity in interaction design: establishing requirements for an interactive product and focusing on making the product usable for the intended population. The third part covers the techniques and knowledge necessary to design an interactive product that is accessible and useful to the people who are expected to use it. Part four presents the techniques and knowledge necessary to design and evaluate an interactive product.
Mode of delivery:
Face-to-face teaching, self-study
Learning activities and teaching methods:
Lectures 18h, assignments or one larger assignment and presentation 56h, exam 34h.
Target group:
Master's level students of the IS Oriented Module (compulsory), Master's level students of the SE Oriented Module (optional) and GS ^{3}D students (optional).
Prerequisites and co-requisites:
Basic knowledge on human-computer interaction with usability and user-centered design.
Recommended or required reading:
Sharp, Rogers and Preece (2007, 2nd or later edition) *Interaction Design: Beyond Human-Computer Interaction* and lecture and assignment materials.
Assessment methods and criteria:
Assignments/assignment and presentation, exam.

Grading:
assignment pass/fail, exam 1-5
Person responsible:
 Anna-Liisa Syrjänen, itsenäinen tapa
Netta Iivari, luennot
Working life cooperation:
No

521147S: Mobile and Social Computing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Leikkaavuudet:

521046A	Mobile Computing	5.0 op
521045S	Mobile Computing	5.0 op

Language of instruction:
In English.
Timing:
Spring, periods 4-5
Learning outcomes:
Upon completing the course the student is able to implement mobile user interfaces, implement online social network applications, explain the fundamental concepts of context awareness and online communities.
Contents:
Mobile interface design and implementation, mobile sensor acquisition, context awareness, social platforms, crowdsourcing, online communities, graph theory.
Mode of delivery:
Face to face teaching.
Learning activities and teaching methods:
Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.
Target group:
Computer Science and Engineering students and other Students of the University of Oulu.
Prerequisites and co-requisites:
No prior courses are required.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
All necessary material will be provided by the instructor.
Assessment methods and criteria:
The assessment is project-based. Students have to complete two group-based activities throughout the semester: build a mobile application (50%), build an online social application (50%). Passing criteria: both elements (mobile application, social application) must be completed, each receiving more than 50% of the available points.
Read more about [assessment criteria](#) at the University of Oulu webpage.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

521148S: Ubiquitous Computing Fundamentals, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Language of instruction:
In English.
Timing:
Autumn, periods 2-3.
Learning outcomes:
Upon completing the course the student is able to apply the knowledge and methods provided in the course in the design, implementation and evaluation of ubiquitous computing systems.
Contents:
Ubiquitous computing systems, privacy, field studies, ethnography, interfaces, location, context-aware computing, processing sequential sensor data.
Mode of delivery:

Face-to-face.

Learning activities and teaching methods:

Lectures 18 h, exercises 18 h, project work 50 h, self-study 47 h. Exercises and project work are completed as group work.

Target group:

M.Sc. students (computer science and engineering) and other Students of the University of Oulu.

Prerequisites and co-requisites:

None.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Required literature: John Krumm (editor) Ubiquitous Computing Fundamentals, Chapman & Hall, 2010, ISBN 978-1-4200-9360-5, 328 pages; selected scientific publications.

Assessment methods and criteria:

The course is passed with an approved project work.

Read more about assessment criteria at the University of Oulu webpage.

Grading:

Numerical scale 1-5; zero stands for a fail.

Person responsible:

Professor Timo Ojala.

Working life cooperation:

None.

A452292: Ubiquitous Computing, advanced module, optionals, 17 - 20 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Advanced Module

Laji: Study module

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

optionals

521479S: Software Project, 7 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Röning

Opintokohteen kielet: English

ECTS Credits:

7

Language of instruction:

Finnish/English, material available in English.

Timing:

Spring, periods 4-6.

Learning outcomes:

After completing the course, students have demonstrated their capabilities to design, develop and test real-life software. Further, they have shown their proficiency in professionally documenting their work during the assignment.

Contents:

Phases of software engineering process: requirement gathering, analysis, design, implementation, testing, (maintenance). Project-work, starting a project, project management, working with external parties, project documentation. Project related implementation techniques and tools, software documentation.

Mode of delivery:

Face-to-face and independent studies.

Learning activities and teaching methods:

Working methods: The course is done in groups of 3-4 students. The clients are typically various companies and societies. Project progress is supervised in formal reviews, where the project teams present their work as it reaches the milestones: the software requirement specification, the project plan, the software design specification, an operational prototype demonstration, the test documentation, and finally the functional software demonstration and release. In addition to formal reviews the project work is coordinated with steering group meetings. The work environment and development tools vary between projects. The number of students that can attend the course is limited.
Lectures 10 h, design project in period 4-6 180 h.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

521457A Software Engineering, 521453A Operating Systems, 521141P Elementary Programming, 521142A Embedded Systems Programming and varying project related background reading.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Pressman, R.S.: Software Engineering A Practitioner's Approach, 4th edition, Mc Graw-Hill, 1997; Phillips, D.: The Software Project Manager's Handbook, IEEE Computer Society, 2000; Project documentation; project related manuals and handbooks.

Assessment methods and criteria:

Project work and documentation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Juha Röning

Working life cooperation:

-

521264S: Human-Computer Interaction Techniques, 5 op

Voimassaolo: 01.08.2005 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

5

Language of instruction:

In English.

Timing:

Autumn, periods 2-3.

Learning outcomes:

Upon completing the course the student is able to explain the HCI fundamentals, explain evaluation and prototyping techniques, explain how HCI can be incorporated in the software development process.

Contents:

Human and computer fundamentals, design and prototyping, evaluation techniques, data collection and analysis.

Mode of delivery:

Face to face teaching.

Learning activities and teaching methods:

Lectures, exercises, and practical work. The course is passed with an approved practical work. The implementation is fully English.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

No prior courses are required.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

All necessary material will be provided by the instructor.

Assessment methods and criteria:

The assessment is project-based. Students have to complete three group-based activities throughout the semester: design & prototyping (40%), conduct an evaluation (40%), and complete a report of the activities (20%). Passing criteria: all 3 elements (designs, evaluation, report) must be completed, each receiving more than 50% of the available points.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Vassilis Kostakos

Working life cooperation:

-

521149S: An introduction to computer vision methods for biomedical images (only for BME-SIP students), 5 - 8 op

Voimassaolo: 01.08.2012 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ojala, Timo Kullervo
Opintokohteen kielet: English
Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5-8

Language of instruction:

English; Finnish when only Finnish-speaking students.

Timing:

Autumn and Spring, periods 1-6.

Learning outcomes:

The learning outcomes are defined based on the course topic.

Contents:

Varies yearly.

Mode of delivery:

Face-to-face teaching, also web-based teaching can be used.

Learning activities and teaching methods:

Lectures, exercises, design exercise, project work and seminars depending on the topic of the year. The implementation of the course will be informed separately. The course can be given several times with different contents during the academic year and it can be included into the degree several times.

Target group:

M.Sc. level students of Computer Science and Engineering; other students are accepted if there is space in the classes.

Prerequisites and co-requisites:

Will be defined based on the contents.

Recommended optional programme components:

No.

Recommended or required reading:

Will be announced at the first lecture

Assessment methods and criteria:

Depends on the working methods.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

CSE dept. professors

Working life cooperation:

-

521489S: Research Work on Information Processing, 8 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

ECTS Credits:

8

Language of instruction:

Finnish/English.

Timing:

Autumn and spring, periods 1-6.

Learning outcomes:

The work will develop skills for being initiative, creativity, application of theoretical knowledge, programming and cooperation. The student will also learn how to document the results of the work in a form of a scientific publication.

Contents:

 A small-scale research work in an active research group. Topics will be selected from the needs of present research activities in the site of work. Main emphasis is on the development and application of methods and algorithms for information processing. Often work includes programming with Matlab, C or Java languages.

Mode of delivery:

Self-study.

Learning activities and teaching methods:

First the research group is studied to get understanding of what are its goals. Detailed task description is written with the advisor. Typically, the work includes study of theoretical background information, programming, testing and simulations, documentation, and presentation. The presentation will include a technical report written in English in the form of a scientific publication, and an oral presentation with slides. Depending on task assignment, a more detailed report may be necessary. Task assignments can be applied at any time all year round.

Target group:

Computer Science and Engineering students + Other Students of the University of Oulu.

Prerequisites and co-requisites:

A prerequisite will be a good success in the studies. Good grades in programming courses are beneficial. Additional criteria are set on the task basis.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Literature and scientific articles depending on the task assignment.

Assessment methods and criteria:

Course assessment is based on the technical report and oral presentation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Professor Timo Ojala.

Working life cooperation:

-

521428S: UBI summer school, 5 op

Voimassaolo: 01.08.2014 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Ojala, Timo Kullervo
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

812335A: Interaction Design, 4 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Information Processing Science
Arvostelu: 1 - 5, pass, fail
Opettajat: Netta Iivari, Anna-Liisa Syrjänen
Opintokohteen kielet: English

ECTS Credits:

4 ECTS credits/108 hours of work

Language of instruction:

English

Timing:

1st year of Master's studies, autumn semester period 2

Learning outcomes:

Objective: The course explains the role of human interaction with products and services, explains the factors and problems related to it to motivate interaction design, and teaches some methods for analysis, evaluation and design of interactions.

Learning Outcomes: After completing the course, the student can assess the role of human interaction with information technological products or services and identify factors and problems related to it within a practical design case. The student is able to:

- use methods for analysis and evaluation of existing interfaces;
- understand the role of requirements, plan and conduct a simple requirements collection and analysis;
- use basic principles of usability for graphical user interface design;
- use interaction design methods to create a novel or redesigned interactive product.

Contents:

The first part provides an overview of interaction design, introducing the key issues and activities of the subject: the terminology and fundamental concepts of the area; the main activities involved in interaction design, and the importance of user involvement in the design process. Part two addresses the key activity in interaction design: establishing requirements for an interactive product and focusing on making the product usable for the intended population. The third part covers the techniques and knowledge necessary to design an interactive product that is accessible and useful to the people who are expected to use it. Part four presents the techniques and knowledge necessary to design and evaluate an interactive product.

Mode of delivery:

Face-to-face teaching, self-study

Learning activities and teaching methods:

Lectures 18h, assignments or one larger assignment and presentation 56h, exam 34h.

Target group:

Master's level students of the IS Oriented Module (compulsory), Master's level students of the SE Oriented Module (optional) and GS ^{3}D students (optional).

Prerequisites and co-requisites:

Basic knowledge on human-computer interaction with usability and user-centered design.

Recommended or required reading:

Sharp, Rogers and Preece (2007, 2nd or later edition) *Interaction Design: Beyond Human-Computer Interaction* and lecture and assignment materials.

Assessment methods and criteria:

Assignments/assignment and presentation, exam.

Grading:

assignment pass/fail, exam 1-5

Person responsible:

 Anna-Liisa Syrjänen, itsenäinen tapa
Netta Iivari, luennot

Working life cooperation:

No

815653S: Open Source Software Development, 4 op

Opiskelumuoto: Advanced Studies

Laji: Course

Vastuuyksikkö: Department of Information Processing Science

Arvostelu: 1 - 5, pass, fail

Opettajat: Henrik Hedberg

Opintokohteen kielet: English

ECTS Credits:

4 ECTS credits/108 hours of work

Language of instruction:

English

Timing:

2 nd year of Master's studies, autumn semester, periods 1 + 2

Learning outcomes:

After completing the course, a student is able to:

- Define the historical background and the ideology of OSS;
- Participate in an OSS development project;
- Evaluate the impact of using OSS and OSS licenses in software development and exploitation;
- View the phenomenon through essential scientific research.

Contents:

Open Source Software (OSS) is one of the most topical phenomena in software development. It affects both software production and the decisions of user organisations. OSS can be studied from different social, legal, economical, software engineering and data security viewpoints. The course covers the range of scientific findings on the OSS paradigm. The course introduces the Open Source Software (OSS) development paradigm and current topics in OSS research. The aim is to study from different viewpoints, for example, what OSS is and what it is not, the history and organisation of OSS projects, methods of OSS development and usage, as well as licensing models and possible risks. The emphasis is on research work.

Mode of delivery:

Mostly face-to-face teaching but some parts are implemented as distance teaching

Learning activities and teaching methods:

Lectures and seminars about 40h, exercises about 10h, seminar paper about 58h.

Prerequisites and co-requisites:

Compulsory prerequisites are bachelor degree or other equivalent degree and basic knowledge of software engineering and research work. The course allows passing Project II following the OSS development principles or a Master's thesis on an OSS topic.

Recommended optional programme components:

Recommended or required reading:

Fogel, K. (2005): Producing Open Source Software - How to Run a Successful Free Software Project, O'Reilly Media; Rosen L. (2004): Open Source Licensing: Software Freedom and Intellectual Property Law, Prentice Hall; international articles covering the topic.

Assessment methods and criteria:

Active participation and a seminar paper
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1-5

Person responsible:

Henrik Hedberg

Working life cooperation:

No

815309A: Real Time Distributed Software Development, 6 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Information Processing Science

Arvostelu: 1 - 5, pass, fail

Opettajat: Petri Pulli

Opintokohteen kielet: English

ECTS Credits:

6 ECTS credits/160 hours of work

Language of instruction:

 English

Timing:

1 st year of Master's studies, autumn semester, periods 1 + 2

Learning outcomes:

After completing the course, the student:

• Is able to analyse the characteristics of real-time distributed systems;
• Is able to acquire an object-oriented, model-based approach to solve the design problems found in real-time systems;
• Is able to detect and derive specific problems facing the real-time software designer, and to suggest design patterns to solve those problems.

Contents:

Introduction
1. Characteristics of real-time systems;
2. Resource management;
3. Safety and reliability;
4. Time constraints;
5. Concurrency;
6. Scheduling;
7. Multitasking, interrupts;
8. Hardware interfaces.
Characteristics of Distribution
1. Centralised;
2. Client-server;
3. Clusters ;
4. Cloud;
5. Peer-to-peer;
6. Ad hoc;
7. Concept of time;
8. Synchronisation;
9. Latency and jitter;
10.   Quality of service;
11.   Service discovery;
12.   Networking primitives;
13.   Networking platforms.

Real-Time UML Modelling Methodology
Real-Time Design Patterns
Design Examples: Embedded, Ubiquitous, Mobile, Web/Internet

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 45h, design exercises 15h, student projects 100h.

Target group:

Prerequisites and co-requisites:

Student understands computer architecture, object-oriented analysis and design (UML), programming language C and/or Java.

Recommended optional programme components:

Recommended or required reading:

Lecture notes based on reference books
• Douglass B.P. (2007) Real-Time UML – Advances in the UML for Real-Time Sys-tems. Third edition. Addison-Wesley ISBN 0-321-16076-2. 694 p.
• Douglass B.P. (2009) Real-Time Design Patterns – Robust Scalable Architecture for Real-Time Systems. Addison-Wesley ISBN 0-201-69956-7. 500 p.

Assessment methods and criteria:

Exam and project evaluation.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1–5

Person responsible:

Petri Pulli

Working life cooperation:

No

817603S: System Design Methods for Information Systems, 5 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Information Processing Science
Arvostelu: 1 - 5, pass, fail
Opettajat: Li Zhao
Opintokohteen kielet: English

ECTS Credits:
5 credits/134 hours of work

Language of instruction:
English
Timing:

1 st year of Master's Studies, autumn semester, period1.

Learning outcomes:
Objective: The objective of the course is to widen students' understanding of methodologies and techniques for information systems development (ISD) and provide students with skills in using the variety of techniques.

Learning Outcomes: After the course the student understands the complexity of business, organizational, technical, and human aspects that affect ISD and the selection of methods in ISD. The student also understands the defects of traditional waterfall model and how other methods aim to answer to these defects and to other challenges in ISD. In particular, with socio-technical methods (e.g., SSM, ETHICS) and their techniques the student is able to re-plan and develop the sub-systems (automated and non-

automated) of organization into a coherent whole and to take into account job satisfaction issues in addition to efficiency demands in ISD and in planning workflows in organization. The student is also able to assess and give arguments which method is suitable for an ISD project in an organization.

Contents:

What is information systems development (ISD), waterfall method, socio-technical methods like SSM and ETHICS, miscellaneous methods or frameworks like evolutionary approach, prototyping, rapid application development, Agile development, XP, business process re-engineering, process innovation, stakeholders analysis, and critical success factors, as well as how to select ISD methods.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 20h, exercises 24h, homework 30h, essay 30h, examination 30h.

Target group:

Prerequisites and co-requisites:

Bachelor studies recommended

Recommended optional programme components:

Recommended or required reading:

Avison, D., Fitzgerald, G. (2006) Information Systems Development, methodologies, techniques & tools. Fourth Edition. London: McGraw-Hill.
Research articles (to be announced during the course implementation).

Assessment methods and criteria:

Exercises, assignments, essay, and examination.

Grading:

1-5

Person responsible:

Li Zhao

Working life cooperation:

No

813624S: Information Systems Theory, 7 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Information Processing Science
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

ECTS Credits:

7 ECTS credits/187 hours of work

Language of instruction:

English

Timing:

2nd year of Master's studies, autumn semester, periods 1 + 2

Learning outcomes:

After completing the course, the student:

- Will have a good knowledge and understanding of a broad array of research topics and themes within the field of information systems;
- Will have good knowledge and understanding of information systems research and the process by which that research is produced;
- Can publish critical IS research articles in some of the leading academic journals and conference proceedings;
- Can critically analyse and synthesise academic sources;
- Can verbally present arguments in an academic fashion;
- Can write a literature review on an IS research topic.

Contents:

1. Information Systems Research Overview
2. A contemporary selection of IS research themes, such as:
- Information systems success and failure;
- Information systems development;
- Understanding the end-user;
- Risk management;
- Cultural Issues in information systems.

Mode of delivery:

Face-to-face teaching

Learning activities and teaching methods:

Lectures 1.5 ECTS credits (40.5h), class preparation 1.5 ECTS (40.5h), and exercises 4 ECTS (107h).

Target group:

Master's level students

Prerequisites and co-requisites:

Bachelor degree or other equivalent degree and **"Research Methods"** course (813621S). 813624S is a substantive overview of research in information systems not a methods course, and students should be familiar with research methods prior enrolling to 813624S.

Recommended optional programme components:

Recommended or required reading:

To be announced during the course implementation

Assessment methods and criteria:

Paper summary and its presentation, active participation in class, class quizzes, research proposal, and research essay are assessed. Note that there is no final exam.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

1–5

Person responsible:

Tero Vartiainen

Working life cooperation:

No

Other information:

Course material can be found at OPTIMA e-learning environment, Urkund is used for course work submissions.

521142A: Embedded Systems Programming, 5 op

Opiskelumuoto: Intermediate Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opettajat: Riekki, Jukka Pekka

Opintokohteen kielet: Finnish

Voidaan suorittaa useasti: Kyllä

ECTS Credits:

5

Language of instruction:

Finnish, the course can be completed in English by answering the lecture questions and by doing the laboratory exercise, the programming exercises and the final exercise.

Timing:

Spring, periods 4-6.

Learning outcomes:

Upon completing the required coursework, the student is able to implement small C programs both in Unix environment and for embedded systems with memory-mapped I/O. Moreover, the student is able to recognize how embedded systems programming differs from programming general-purpose computers.

Contents:

Basics of C, bitwise operations, memory management, memory-mapped I/O devices, hardware registers, interrupts, compiling and linking.

Mode of delivery:

Web-based teaching + face-to-face teaching

Learning activities and teaching methods:

20 h lectures, 3 h laboratory exercise; 10-20 h voluntary guided practising, the rest as independent work alone and in the two-person groups.

Target group:

1st year students of computer science and engineering and electrical engineering and other Students of the University of Oulu.

Prerequisites and co-requisites:

The following courses must be completed prior to applying for the course: 521141P Elementary programming.

Recommended optional programme components:

The course "521267A Computer Engineering" is recommended to be completed simultaneously.

Recommended or required reading:

Will be announced at the beginning of the course.

Assessment methods and criteria:

Students answer questions after each lecture, participate the laboratory exercise, and do the programming exercises and the final exercise. Assessment is based on these three elements; passing the course requires points from each element. More detailed information on assessment can be found from http://www.oulu.fi/cse/studying/courses.
Read more about assessment criteria at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Jukka Riekki

Working life cooperation:

-

521275A: Embedded Software Project, 8 op

Voimassaolo: 01.08.2007 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail
Opettajat: Teemu Tokola, Juha Röning
Opintokohteen kielet: English

ECTS Credits:

8

Language of instruction:

Material of the course is available in English, lecturing is given in English.

Timing:

Spirng, periods 4-6.

Learning outcomes:

Embedded software project is the final course in the Bachelor's degree. The skills to pass this course have been acquired in precious courses. During the course, students work in groups to implement a program into an embedded system and write a technical report of the work. The subject of the program is not necessarily covered in previous courses.
After completing the course work, students have demonstrated that they can employ their skills in acquiring information to find a feasible solution to a given problem while still addressing the constraints imposed by a given embedded system. The student has shown that they are capable of designing and then implementing the non-trivial solution as a program to the given embedded system. Furthermore, they have demonstrated that they are capable of writing good-quality scientific text, including a literature survey, theory, technical documentation, testing documentation and other necessary chapters.

Contents:

This course fam-ilairizes the student with modern embedded system development with modern methods and tools. Topics: Development tools, practical application program for an embedded system.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

Pair project with monitoring meetings and a compulsory exercise. Lectures 30 h, design exercise in period 4-6 180 h.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

521457A Software Engineering, 521142A Embedded Systems Programming. In addition, 521453A Operating Systems be beneficial.

Recommended optional programme components:

The course is an independent entity and does not require additional studies carried out at the same time.

Recommended or required reading:

Data periodicals, handouts, handbooks

Assessment methods and criteria:

Project report.
Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Juha Röning, Teemu Tokola

Working life cooperation:

None.

521423S: Embedded System Project, 5 op

Opiskelumuoto: Advanced Studies
Laji: Course

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opettajat: Juha Röning

Opintokohteen kielet: English

ECTS Credits:

5

Language of instruction:

Lecturing in Finnish, material available in English

Timing:

Autumn, periods 1-3.

Learning outcomes:

After passing the course a student can explain the life cycle of the embedded system, the characteristic features related to embedded systems development, and the risks involved. In addition, the student can explain the roles of the client and the system developer during the requirements specification, and the role of the iteration phase as a part of the requirements specification phase. The student can explain the factors affecting to SW/HW partitioning process, and the concept of SW/HW dualism. The student can fairly analyze the factors affecting to the selection of the processor and the operating system. The student can recognize the basic development tools used and their possible advantages and disadvantages. The student can compare various testing approaches. The student can explain how a design error affects to the final cost of the system in different phases of the development. The student can do some basic I/O programming using C programming language.

Contents:

The embedded design life cycle, the selection process, the partitioning decision, the development environment, the special software techniques, a basic toolset, JTAG/ICE, testing, I/O programming.

Mode of delivery:

Face-to-face teaching.

Learning activities and teaching methods:

The course is run in a project work in groups of two and follow up the progress reporting meetings. Lectures 20 h, laboratory exercise in period 1-3 120 h.

Target group:

Computer Science and Engineering students and other Students of the University of Oulu.

Prerequisites and co-requisites:

521412A Digital Techniques I, 521267A Computer Engineering and Embedded Systems.
Also recommended 521275A Embedded Software Project, Principles of Electronics Design.

Recommended optional programme components:

Digital Techniques I, Computer Engineering, Embedded Systems. Also recommended Embedded Software Project, Principles of Electronics Design.

Recommended or required reading:

Berger, Arnold S. (2002) Embedded Systems Design: An introduction to Processes, Tools, & Techniques, CMP Books, USA. ISBN:1578200733.

Assessment methods and criteria:

Project work.
Read more about [assessment criteria](#) at the University of Oulu webpage.

Grading:

The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.

Person responsible:

Juha Röning

Working life cooperation:

None.

521400S: CSE MasterŽs Thesis Seminar, 1 op

Voimassaolo: 01.08.2013 -
Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Language of instruction:
English/Finnish
Timing:
Autumn and Spring, periods 1-6.
Learning outcomes:
After completing the course the student can prepare a presentation of predetermined length of her/his thesis and have experience on presenting the topic. In addition, she/he has experience on evaluating other students' presentations and has a general view of completed master's theses.
Contents:
The content is determined by the master's theses topics and other current research topics.
Mode of delivery:
Seminar presentations.
face-to-face teaching and Self-study.
Learning activities and teaching methods:
Face-to-face about 4 hours and independent work about 23 hours.
The student is required to participate in at least 4 seminars. In one of those, the student has to give an oral presentation of his/her diploma work. Presentations are given in English, and their length is approximately 30 minutes. Seminars are given during the whole year when necessary. The presentation is prepared independently and the amount of work is case-specific.
Target group:
Second year M.Sc. students of the CSE degree programme.
Recommended optional programme components:
The course is an independent entity and does not require additional studies carried out at the same time.
Recommended or required reading:
Instructions for preparing a master's thesis document in the CSE degree programme.
Assessment methods and criteria:
The student is required to participate in at least 4 seminars. In one of those, the student has to give an oral presentation of his/her diploma work. Presentations are given in English. Seminars are given during the whole year when necessary.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The course uses verbal scale pass / fail.

521009S: The Maturity Test for Master`s Degree, 0 op

Opiskelumuoto: Advanced Studies
Laji: Course
Vastuuyksikkö: Department of Computer Science and Engineering
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish
Voidaan suorittaa useasti: Kyllä

Ei opintojaksokuvauksia.

Tutkintorakenteisiin kuulumattomien opintokokonaisuuksien ja -jaksojen kuvaukset

521993S: Master's Thesis in Computer Engineering, 30 op

Opiskelumuoto: Advanced Studies

Laji: Diploma thesis

Vastuuyksikkö: Department of Computer Science and Engineering

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
30
Language of instruction:
Finnish/English
Timing:
Second year of MSc studies
Learning outcomes:
The student is able to set goals for a given task. He can structure the topic coherently, with emphasis on the key issues. Depending on the nature of the work, the student is able to present the existing results or technological implementations so that the methods used in the work are justified in relation to the state of the art in the field of engineering or science in question. He is able to apply the knowledge and state of the art methods of the subject area in his work. He can present clearly his plan and solution implemented, justify the choices made, and assess the functionality of the solution with relevant testing and evaluation methods. In addition, he is able to compare the results against goals and to consider their general significance to modern engineering or science, and assess the broader significance of the results to the company, organization or project. The student is able to produce smooth, clear and finalized text based on technical and scientific writing practices of the field.
Contents:
The thesis work is carried out independently. The student defines the content of the thesis under the guidance of the supervisor. The degree program committee approves the thesis topic and content.
The thesis is recorded in accordance with the orientation using the following codes:
- 521981S Master's Thesis in Information Processing Engineering, 30 ECTS cr
- 522985S Master's Thesis in Applied Computing, 30 ECTS cr
- 521984S Master's Thesis in Embedded Systems, 30 ECTS cr
Mode of delivery:
Face-to-face meetings with the supervisor and independent studying.
Learning activities and teaching methods:
Independent work under the guidance of the supervisor.
Target group:
Second year MSc students.
Prerequisites and co-requisites:
Compulsory advanced studies preceding the thesis (90 ECTS cr).
Recommended optional programme components:
-
Recommended or required reading:
-
Assessment methods and criteria:
The thesis is assessed by two reviewers (supervisor and second reviewer) and approved by the degree program committee. Assessment Criteria at the University of Oulu can be found here.
Grading:
1-5 (1=sufficient, 2=satisfactory, 3=good, 4=very good, 5=excellent)
Person responsible:
Supervising professor or researcher
Working life cooperation:
Yes.
Other information:
Detailed instructions: http://www.oulu.fi/cse/studying/masters-thesis