Opasraportti

Information Prosessing Science (2015 - 2016)

Studies in Information Processing Science create excellent basis for work in all places where information technology is developed and applied. ICT sector still advances significantly and becomes more international. There is notable demand for experts of the field. Degree programme in Information Processing Science in University of Oulu provides good employment and career development opportunities on the top of ICT sector. Education in Information Processing Science focuses in information systems and software engineering as well as knowledge areas and applications supporting those. At the same time, general skills required in working life, such as project work, language, written and oral communication, group work and problem solving skills, are trained.

In addition to these pages, information on studies is available in the study guide in the wiki pages of the degree programme.

Tutkintorakenteet

European Masters in Software Engineering (EMSE)

Tutkintorakenteen tila: published

Lukuvuosi: 2015-16

Lukuvuoden alkamispäivämäärä: 01.08.2015

First Year in Oulu (60 op)

815303A: Embedded Software Development Environments, 5 op
811601S: Emerging Trends in Software Testing, 5 op
812349A: IT Infrastructure, 5 op
521147S: Mobile and Social Computing, 5 op
521260S: Programmable Web Project, 5 op
815305A: Real Time Distributed Software Development, 5 op
813621S: Research Methods, 5 op
817602S: Software Development in Global Environment, 5 op
815662S: Software Engineering Management, Measurement and Improvement, 5 op
815663S: Software Engineering Research, 5 op
815312A: Software Production and Maintenance, 5 op
815311A: Software Quality and Testing, 5 op

Second Year in Oulu (60 op)

811600S: Emerging Trends in Software Engineering, 5 op

813613S: Master's Thesis, 30 op
813627S: Master's Thesis Seminar, 2 op
813607S: Maturity test, 0 op
815657S: Open Source Software Development, 5 op
817609S: Project Seminar, 3 op
817612S: Research and Development Project, 10 op
817602S: Software Development in Global Environment, 5 op

Degree Programme in Information Processing Science, Master's Level Studies (120 ECTS)

Tutkintorakenteen tila: published

Lukuvuosi: 2015-16

Lukuvuoden alkamispäivämäärä: 01.08.2015

Compulsory Studies for all Master's Level Students (vähintään 50 op)

813613S: Master's Thesis, 30 op
813627S: Master's Thesis Seminar, 2 op
817609S: Project Seminar, 3 op
813621S: Research Methods, 5 op
817612S: Research and Development Project, 10 op

Specialization Studies (vähintään 40 op)

For the master's studies, a student should choose either information systems or software engineering as his/her study orientation. The choice will be made at the end of the bachelor studies or at the latest at the beginning of the master's studies, by defining it explicitly as part of the personal study plan.

Software Engineering Oriented Module

815303A: Embedded Software Development Environments, 5 op
815657S: Open Source Software Development, 5 op
815305A: Real Time Distributed Software Development, 5 op
817602S: Software Development in Global Environment, 5 op
815662S: Software Engineering Management, Measurement and Improvement, 5 op
815663S: Software Engineering Research, 5 op
815312A: Software Production and Maintenance, 5 op
815311A: Software Quality and Testing, 5 op

Information Systems Oriented Module

813626S: Emerging Technologies and Issues, 5 op
812351A: Enterprise Systems, 5 op
  Compulsory
    812351A-01: Enterprise Systems, exercise work, 0 op
    812351A-02: Enterprise Systems, exam, 0 op
817604S: ICT and Organizational Change, 5 op
812349A: IT Infrastructure, 5 op
813623S: Information Security Policy and Management in Organisations, 5 op
813625S: Information Systems Theory, 5 op
812331A: Interaction Design, 5 op
817603S: System Design Methods for Information Systems, 5 op

Optional Studies (vähintään 30 op)

Optional studies must be at least 30 ECTS credit points. Optional courses can be chosen either in the advanced (Advanced Module) supply or the second specialisation option compulsory courses, or both. Also a minor, or carried out elsewhere in higher education approved elective courses.

Optional Studies for IS Oriented Module Students

817610S: Doing Software Business in China, 5 op
815657S: Open Source Software Development, 5 op
815305A: Real Time Distributed Software Development, 5 op
814340A: Small-Group Tutoring, 3 op
817602S: Software Development in Global Environment, 5 op
815662S: Software Engineering Management, Measurement and Improvement, 5 op
815312A: Software Production and Maintenance, 5 op
815311A: Software Quality and Testing, 5 op
812670S: The Next Generation of the Web, 5 op
812671S: Usability Testing, 5 op
814601S: Work Experience in ICT responsibilities, 5 op

Optional Studies for SE Oriented Module Students

817610S: Doing Software Business in China, 5 op
813626S: Emerging Technologies and Issues, 5 op
812351A: Enterprise Systems, 5 op
   Compulsory
      812351A-01: Enterprise Systems, exercise work, 0 op
      812351A-02: Enterprise Systems, exam, 0 op
812349A: IT Infrastructure, 5 op
813623S: Information Security Policy and Management in Organisations, 5 op
814340A: Small-Group Tutoring, 3 op
817603S: System Design Methods for Information Systems, 5 op
812670S: The Next Generation of the Web, 5 op
812671S: Usability Testing, 5 op
814601S: Work Experience in ICT responsibilities, 5 op

Minor or other studies

Masters Degree Programme in Software, Systems and Service Development (GS3D) 2015-2016 (120 op)

Tutkintorakenteen tila: published

Lukuvuosi: 2015-16

Lukuvuoden alkamispäivämäärä: 01.08.2015

Compulsory Studies (vähintään 95 op)

902140Y: Cross-Cultural Competence and Communication Skills, 2 op
817604S: ICT and Organizational Change, 5 op
812349A: IT Infrastructure, 5 op
813623S: Information Security Policy and Management in Organisations, 5 op
813625S: Information Systems Theory, 5 op
813613S: Master's Thesis, 30 op
813627S: Master's Thesis Seminar, 2 op
815657S: Open Source Software Development, 5 op
811392A: Preparatory Course for MSc Studies, 5 op
813621S: Research Methods, 5 op
813630S: Software Business Development, 5 op

813620S: Software Business Management, 5 op
817602S: Software Development in Global Environment, 5 op
815662S: Software Engineering Management, Measurement and Improvement, 5 op
815663S: Software Engineering Research, 5 op
817614S: Software Factory Project, 10 op
817603S: System Design Methods for Information Systems, 5 op

Optional Studies (vähintään 25 op)

Optional studies must be at least 25 ECTS credit points. Optional courses can be chosen in the optional course pool (see below). Also a minor, or carried out elsewhere in higher education approved elective courses.

812650S: Advanced Topics in Human-Centred Design, 5 op
817610S: Doing Software Business in China, 5 op
813626S: Emerging Technologies and Issues, 5 op
812351A: Enterprise Systems, 5 op
   Compulsory
      812351A-01: Enterprise Systems, exercise work, 0 op
      812351A-02: Enterprise Systems, exam, 0 op
812331A: Interaction Design, 5 op
817609S: Project Seminar, 3 op
815305A: Real Time Distributed Software Development, 5 op
815312A: Software Production and Maintenance, 5 op
815311A: Software Quality and Testing, 5 op
812670S: The Next Generation of the Web, 5 op

Degree Programme in Information Processing Science, Bachelor Level Studies 2015-2016

Tutkintorakenteen tila: published

Lukuvuosi: 2015-16

Lukuvuoden alkamispäivämäärä: 01.08.2015

Generel Studies (2 op)

810020Y: Orientation Studies, 2 op

Language and Communication Studies (10 op)

902002Y: English 1 (Reading for Academic Purposes), 2 op
902004Y: English 2 (Scientific Communication), 2 op
900095Y: Oral Communication, 2 op
901049Y: Second Official Language (Swedish), Oral Skills, 1 op
901048Y: Second Official Language (Swedish), Written Skills, 1 op
900094Y: Written Communication, 2 op

Basic Studies (40 op)

810122P: Computer Architecture, 5 op
811120P: Discrete Structures, 5 op
811177P: Humans as Users and Developers of Information Technology, 5 op
811168P: Information Security, 5 op
810136P: Introduction to Information Processing Sciences, 5 op
811167P: Introduction to Information Systems Design, 5 op

Compulsory
    811167P-01: Introduction to Information Systems Design, exercise work, 0 op
    811167P-02: Introduction to Information Systems Design, exam, 0 op
811122P: Introduction to Programming, 5 op
811174P: Introduction to Software Business, 5 op

Intermediate Studies (97 op)

812339A: Advanced Object-Oriented Programming, 5 op
  Compulsory
    812339A-01: Advanced Object-Oriented Programming, exercise work, 0 op
    812339A-02: Advanced Object-Oriented Programming, exam, 0 op
811383A: Bachelor Thesis, 7 op
811395A: Basics of Databases, 5 op
811379A: Basics of Human Computer Interaction, 5 op
811344A: Basics of Statistical Data Analysis for Information Processing Science, 5 op
  Compulsory
    811344A-01: Basics of Statistical Data Analysis for Information Processing Science, exercise work, 0 op
    811344A-02: Basics of Statistical Data Analysis for Information Processing Science, exam, 0 op
813316A: Business Process Modeling, 5 op
811312A: Data Structures and Algorithms, 5 op
811394A: Database systems, 5 op
812332A: Information Systems Design, 5 op
812305A: Information Systems in Organisations, 5 op
521150A: Introduction to Internet, 5 op
811393A: Introduction to research work, 5 op
812342A: Object Oriented Analysis and Design, 5 op
812341A: Object-Oriented Programming, 5 op
  Compulsory
    812341A-01: Object-oriented programming, exercise work, 0 op
    812341A-02: Object-oriented programming, exam, 0 op
811366A: Project Work, 10 op
811391A: Requirements Engineering, 5 op
815345A: Software Architectures, 5 op
811346A: Software Engineering, 5 op
811375A: User Interface Programming, 5 op

Minor Studies (25 op)

Other Studies (1 op)

030005P: Information Skills, 1 op

Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

814311A: Internship in ICT-duties, 3 - 5 op
815338A: Principles of Programming Languages, 5 op
812315A: Software Construction, 10 op

Opintojaksojen kuvaukset

Tutkintorakenteisiin kuuluvien opintokohteiden kuvaukset

815303A: Embedded Software Development Environments, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Juustila, Antti Juhani
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 133 hours of work
Timing:
1 st year of Master's and GS 3D studies, spring semester, period 4
Learning outcomes:
After completing the course, a student is able to work with the essential software development tools of a selected embedded platform. The student is able to implement memory and power efficient applications by exploiting existing libraries and knowledge of the programming interfaces provided by the platform.
Contents:
The focus of the course is in the software development environments and tools for mobile and embedded platforms, such as Android, iOS, and Windows Phone. In addition, the course covers memory and power management, core services of the platform, and the utilisation of existing libraries. One platform will be selected for deeper study, and the course introduces its essential software development tools and libraries. The emphasis is on application development for the platform as an exercise.
Mode of delivery:
Blended teaching
Learning activities and teaching methods:
Lectures and exercises about 40 h, exercises and exercise work 93 h
Prerequisites and co-requisites:
Course "815309A Real-time Distributed Software Development", C/C++ and/or Java programming skills or similar knowledge obtained from other courses.
Recommended or required reading:
Course material, the documentation of selected technologies, and other related literature
Assessment methods and criteria:
Exercise work
Grading:
1-5
Person responsible:
Antti Juustila

811601S: Emerging Trends in Software Testing, 5 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Mika Mäntylä
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/136 hours of work

Language of instruction:
English
Timing:
1st year of Master's studies, autumn semester, period 2
Learning outcomes:
The student grasps the mathematical foundations of software testing and knows the current research areas related to software testing. The student is able to read research papers on software testing and can participate in academic discussions of those papers. The student can apply the software testing techniques in a test-driven fashion. .

Contents:
Finite state machines, data/ control flow graphs, data-flow testing, model-based testing, mutation/ search based testing, test case selection/ prioritization, security testing, test-driven development
Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 24h, exercises/ assignments 24h, weekly study 48h, paper reading 40h
Target group:

Prerequisites and co-requisites:
815311A (Software Quality and Testing).
Recommended optional programme components:

Recommended or required reading:
- Pezze M.,Young M., "Software Testing and Analysis: Process, Principles and Techniques", John Wiley&Sons, 2008
- Lasse Koskela, "Test Driven: Practical TDD and Acceptance TDD for Java Developers", Manning Publications, 2007

Assessment methods and criteria:
Active and regular attendance (mandatory) to lectures and exercises
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail
Person responsible:
Mika Mäntylä
Working life cooperation:
No
Other information:
It is not possible to complete the course remotely or with self-study options.

812349A: IT Infrastructure, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Katja Leiviskä

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
English
Timing:
1st year of Master's studies, spring semester, period 4

Learning outcomes:
After completing the course, students are able to judge, compare and apply data communications concepts to various situations encountered in industry; identify general concepts and techniques of data communications; explain the technology of the Internet; identify the most important server and storage architectures and the main mechanisms for providing high-capacity processing and storage capacity; and explain the regulatory environ-ment.

Contents:
1. Introduction to large-scale computing applications;
2. Network requirements and architecture;
3. Standards and standards bodies;
4. Network services and Middleware;
5. Internet services, protocols and technologies;
6. Underlying network technologies;
7. Performance monitoring, fault detection, recovery and restoration;
8. Next-generation network infrastructure, industry technology directions.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (24 h), student project work (90 h) and examination (20 h).
Target group:

Prerequisites and co-requisites:
Student is familiar with basic computer architecture and the Internet.
Recommended optional programme components:

Recommended or required reading:
• Lecture notes;
• Supplementary technical and scientific articles;
• Phil Simon (2010) The next wave of technologies: opportunities from chaos. Wiley. ISBN 0-47-058750-4.

Reference books:
• Comer, D.E. (2009) Computer Networks and Internets. 5th edition. Pearson ISBN 0-13-504583-5. 600 p.
• Kurose J.F., Ross K.W. (2010) Computer Networking – A Top-Down Approach. 5th edition. Pearson ISBN 0-13-136548-7. 888 p.
• Travostino F., Mambretti J., Karmous-Edwards G. (2006) Grid Networks – Enabling grids with advanced communication technology. Wiley ISBN 0-470-01748-1. 340 p.

Assessment methods and criteria:
Individual project work, examination
Read more about assessment criteria at the University of Oulu webpage.
Grading:
 1–5
Person responsible:
 Anssi Öörni
Working life cooperation:
No

521147S: Mobile and Social Computing, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Denzil Teixeira Ferreira

Opintokohteen kielet: Finnish

Leikkaavuudet:

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

ECTS Credits:
5
Language of instruction:
In English.
Timing:
Spring, periods 3-4

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 an individual project throughout the semester: either build a mobile application, or conduct analysis of a provided dataset. Passing criteria: the project must be must be completed, 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
Denzil Ferreira
Working life cooperation:
None.

521260S: Programmable Web Project, 5 op

Voimassaolo: 01.08.2006 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Ivan Sanchez Milara, 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 3-4.
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 APIs, hypermedia, transactional/non-transactional databases , RESTful clients (HTML5 and Javascript).
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".

815305A: Real Time Distributed Software Development, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Petri Pulli

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/135 hours of work
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. Interrupts
Characteristics of Distribution
1. Distribution architectures
2. Concept of time;
3. Synchronisation;
4. Latency and jitter;
5. Quality of service;

6. Service discovery;
7. Networking primitives

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 40h, design exercises 15h, student project 80h.
Prerequisites and co-requisites:
Student understands computer architecture, object-oriented analysis and design (UML), programming language C and/or Java.
Recommended or required reading:
Lecture notes based on reference books
• 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
Grading:
1-5
Person responsible:
Petri Pulli

813621S: Research Methods, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Arto Lanamäki

Opintokohteen kielet: English

Leikkaavuudet:

521146S   Research Methods in Computer Science   5.0 op

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
English
Timing:
The course starts in autumn and continues to spring semester (periods 2 and 3). It is recommended that the course is completed during the first year of Master's studies.

Learning outcomes:
Having completed the course, the student is able to explain the general principles of scientific research and the practices of scientific methodology. The student is also able to generate research problems in information systems and software engineering. The student is able to identify and describe the main research approaches and methods in information systems and software engineering and choose the appropriate approach and method for a research problem. The student is also able to evaluate the methodological quality of a research publication. After the course the student is able to choose and apply the proper approach and method for his or her Master's thesis and find more information on the method from scientific literature.
Contents:
Introduction to general scientific principles, scientific research practices and quality of scientific publications, qualitative research approaches and selected research methods, quantitative research approaches and selected research methods, design science research and selected methods, requirements and examples of Master's theses, evaluation of research.

Mode of delivery:
Face-to-face teaching and independent studying.

Learning activities and teaching methods:

Lectures 40h, exercises 30h and individual work 65h. Learning diary is written about the lectures and exercises. Exercises include group work.

Target group:

Prerequisites and co-requisites:
Completion of Bachelor's studies

Recommended optional programme components:

Recommended or required reading:
Lecture slides and specified literature

Assessment methods and criteria:
Accepted learning diary

Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail

Person responsible:
Arto Lanamäki
Working life cooperation:
No
Other information:
-

817602S: Software Development in Global Environment, 5 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Similä, Jouni Kalervo
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/135 hours of work.

Language of instruction:
English
Timing:

1 st year of Master's studies, fall semester.
Learning outcomes:
After completing the course, the student

- Can define the key success factors of Global Software Design (GSD) and the potential problems in coordination of projects where teams are separated by physical and/or temporal distance;
- Can define and evaluate the collaborative technologies, which in the best way support distributed software development;
- Can choose the methods and tools for distributed software development;
- Can apply the practices of GSD in a student project and use the supporting tools throughout the project life cycle.

Contents:
Some of the topics covered are strategic issues in distributed development (off-shoring, near-shoring, outsourcing, OSS); cost-benefit-risk analysis; the triad of coordination, control and communication; team building (e.g. virtual teams); software process paradigms in the global environment (planned, agile); methods and tools for distributed software development; issues related to allocation of tasks; communication issues that arise due to distance and time zone differences; infrastructure support; geographical dispersion; lack of information communication; coordination complexity; cultural issues; technical issues related to information and artefact sharing; architectural design; and

finally knowledge management issues. The lectures and seminars also review current research aspects of the GSD and related case studies from industry. The exercises demonstrate distributed software development as a virtual team with the support of appropriate methods and tools.

Mode of delivery:
Face-to-face lectures and seminars with all the students. Lecture assignments: reading articles and writing analyses. Communication between exercise groups of 4 students is done over the internet.

Learning activities and teaching methods:
Lectures and seminars involving all the students as well as lecture assignments (reading articles and writing analyses) 70h (20h lecture attendances, 30h lecture assignments, 20h additional reading), and exercises 65h. For lecture assignments each student will read, summarize and analyse selected academic articles. The exercises include laboratory demonstrations of different supporting tools for distributed software development. The students train in project software development and planning practices in a distributed environment. The student project groups are organised into virtual (distributed) teams of 4 students.

Target group:
Obligatory course for students majoring in Software Engineering and GS3D.

Recommended or required reading:
To be announced during the course implementation.

Assessment methods and criteria:
By active participation or alternatively exam, based on the course study materials.

Grading:
1–5, active participation: lectures (25%), lecture assignments (25%), exercises (50%).

Person responsible:
Jouni Similä

Working life cooperation:
No

Other information:
Participation: The course is obligatory for GS ^{3}D students and software engineering students; the total number of students is limited according to the departmental selection rule (valintasääntö, kts. Opinto-opas). 80% attendance is required. Web page **:**
https://noppa.oulu.fi/noppa/kurssi/817602s/etusivu

815662S: Software Engineering Management, Measurement and Improvement, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Oivo, Markku Tapani

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work

Timing:
2 nd year of Master's and GS ^{3}D studies, autumn semester, period 2

Learning outcomes:
After completing the course the student understands the fundamental principles of software processes and their development in professional software engineering. The course extends the quality understanding based on individual techniques (e.g. reviews) so that after completing the course the student is able to:

- Evaluate different methods and techniques;
- Select from them appropriate ones for different software engineering environments;
- Have capabilities to participate in systematic efforts for improvement in software companies.

Contents:
The course covers the most fundamental process centred software quality improvement and management approaches, methods and latest research results, as well as approaches to software measurement. The topics of the course include: traditional waterfall, agile (extreme programming, scrum, rational unified process, crystal, feature driven development, adaptive software development, dynamic systems development method) and lean methods, process improvement approaches, software process and product measurement, agile and lean practices, process improvement at the enterprise level and practical examples from software industry.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 18h, study group working 25h, paper reading 25h, seminar 20h, report writing 20h
Prerequisites and co-requisites:
 B.Sc. or other equivalent degree and basic knowledge of software engineering
Recommended or required reading:
   • CMMI: Guidelines for Process Integration and Product Improvement. Mary Beth Chrissis, Mike Konrad, Sandy Shrum. Addison-Wesley, ISBN 032-115496-7, 2004.
   • Agile Project Management with Scrum. Ken Schwaber, Microsoft Press, ISBN 0-7356-1993-X. 2004.
   • Dingsøyr T., Dybå T., Moe N.B., Agile Software Development: Current Research and Future Directions, Springer, 2010
   • C. Jones, Applied Software Measurement: Global Analysis of Productivity and Quality, 3rd ed. McGraw-Hill Osborne Media, 2008.
   • Craig Larman and Bas Vodde, Scaling Lean & Agile Development: Thinking and Organizational Tools for Large-Scale Scrum, Addison-Wesley, 2009

Assessment methods and criteria:
Active and regular participation to lectures and seminars AND report evaluation AND seminar presentations
Grading:
1-5
Person responsible:
Markku Oivo

815663S: Software Engineering Research, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Burak Turhan
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/132 hours of work
Timing:
2 nd year of Master's studies, autumn semester, period 1+2

Learning outcomes:
After completing the course the student will know the current research areas in software engineering and the most important software engineering research methods. The student understands academic research and publishing in software engineering, and is able to critically analyse scientific articles from the viewpoint of the content and research methods used in the article. The student is able to present academic research and actively participate in an academic discussion of research papers and research results.
Contents:
Empirical research methods for software engineering: experiments, case studies, surveys, systematic literature reviews and replications in software engineering. Research topics in empirical software engineering.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures and seminars 33h, assignments and paper reading 33h, weekly study 66h.
Prerequisites and co-requisites:
B.Sc. or other equivalent degree
Recommended or required reading:

- Wohlin C., Runeson P., Höst M., Ohlsson M., Regnell B., Wesslen A., Experimentation in Software Engineering, Springer, 2012,.
- Per Runeson, Martin Host, Austen Rainer, Bjorn Regnell: Case Study Research in Software Engineering: Guidelines and Examples, Wiley, 2012.

Assessment methods and criteria:
Active and regular attendance (mandatory) to lectures and seminars.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:
Burak Turhan
Other information:
It is not possible to complete the course remotely or with self-study options.

815312A: Software Production and Maintenance, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Saukkonen, Samuli

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/133 hours of work
Timing:
1 st year of Master's and GS ^{3}D studies, spring semester, period 3
Learning outcomes:
After completing the course, the student:

- Can apply the framework of product line engineering in large scale software production;
- Can apply the maintenance process and techniques in software production.

Contents:
Product line engineering
1. Product line variability;
2. Domain engineering;
3. Application engineering;
4. Transition strategies and organisational issues.
Software maintenance
1. Categories of maintenance;
2. Corrective maintenance;
3. Other forms of maintenance.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 20h, study group working and weekly discussion sessions with the teacher on 8 assignments, together with report writing, 113h.
Prerequisites and co-requisites:
 Basic knowledge of software engineering and software architectures.
Recommended or required reading:
- Pohl, K., Böckle, G., van der Linden, F. Software Product Line Engineering. Foundations, Principles, and Techniques, Springer-Verlag, 2005; chapters 1-5, 10, 15, 19-20.
- Chastek G.J., Donohoe P., McGregor J.D., Formulation of a Production Strategy for a Software Product Line, Technical Note CMU/SEI-2009-TN-025, Carnegie Mellon, 2009
- Gopalaswamy, R., Ramesh, B., Software maintenance: effective practices for geographically distributed environments, Tata McGraw-Hill, 2006 - Computers - 456 pages; chapters 1-6.

Assessment methods and criteria:
 Active participation: 8 weekly assignments to be assessed separately. The final grade will be the sum of all assignments. "Conventional" participation: written exam.

Grading:
1-5
Person responsible:
Samuli Saukkonen

815311A: Software Quality and Testing, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Burak Turhan

Opintokohteen kielet: English

Leikkaavuudet:

ay815311A   Software Quality and Testing (OPEN UNI)   5.0 op

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
1 st year of Master's studies, autumn semester, period 1
Learning outcomes:
The student understands different views on software quality and the role of reviews, inspection and testing as a part of software engineering and defect removal techniques. The student can conduct the review as part of review team and use an appropriate supporting tool. The student knows testing levels, strategies and techniques, can create test cases and conduct unit testing with appropriate testing tools. The student knows the possibilities of test driven development, test automation and models for reviewing.
Contents:
Software quality and quality assurance. Software reviews and inspection. Fundamental concepts of software testing. Software testing techniques. Test-driven development. Test automation.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 32h, study group working 24h, paper reading 24h, exercises 24h, report writing 30 h
Target group:

Prerequisites and co-requisites:
Basic knowledge of software engineering, knowledge of Java programming language.
Recommended optional programme components:

Recommended or required reading:
To be announced during the course implementation but initially planned to be:
• Pezze M.,Young M., "Software Testing and Analysis: Process, Principles and Tech-niques", John Wiley&Sons, 2008
• A. P. Mathur, "Foundations of Software Testing", Prentice Hall, 2008
• Paul Ammann, Jeff Offutt, "Introduction to Software Testing", Cambridge University Press, 2008
• Kent Beck, "Test-Driven Development by Example", Addison-Wesley, 2002
• Lasse Koskela, "Test Driven: Practical TDD and Acceptance TDD for Java Devel-opers", Manning Publications, 2007
• Galin D., "Software Quality Assurance: From theory to implementation", Addison-Wesley, 2004
Assessment methods and criteria:
Report and exercise evaluation, active and regular attendance to lectures and exercises.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1–5
Person responsible:
 Burak Turhan
Working life cooperation:
No

811600S: Emerging Trends in Software Engineering, 5 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Mika Mäntylä
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits /133 hours of student work
Language of instruction:
English
Timing:
 1.-2. year of Master's studies, period 1-2
Learning outcomes:
The learning outcomes are defined based on course topic.
Contents:
Varies yearly.
Mode of delivery:
Face-to-Face teaching.
Learning activities and teaching methods:
Lectures, exercises, design exercise, group work and seminars depending on the topic of the year. The
implementation of the course will be informed separately. 133 hours of student work.
Target group:
 All Master's level, EMSE, and GS3D students
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.
Grading:
 The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail.
Person responsible:
 Mika Mäntylä
Working life cooperation:
No

813613S: Master's Thesis, 30 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Studies
Laji: Diploma thesis
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

ECTS Credits:
30 ECTS credits/800 hours of work.

Language of instruction:
Finnish/English.

Timing:
Timing is free; execution can be allocated over several semesters. Obligatory for Master's degree. During 1st and
2nd year of Master's studies.
Learning outcomes:

After completing the thesis the student can:

- Define a relevant focused problem in the field of information processing science;
- Apply a scientific method as a tool in solving the stated research problem;
- Synthesise research results and evaluate their validity;
- Write a scientific thesis based on the accomplished research according to the de-partment's guidelines;
- Participate in the evolution of ICT and postgraduate studies after completing the thesis.

Mode of delivery:
Face-to-face meetings and electronic communication with the supervisor.

Learning activities and teaching methods:
Conducting and reporting research under supervision of personal advisor.

Prerequisites and co-requisites:
The research plan and the final draft of the thesis will be presented in the "Master's Thesis Seminar" (813602S).

Assessment methods and criteria:
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The supervisor and a second independent reviewer will evaluate the thesis using the scale 1–5.

Person responsible:
Kari Kuutti

Working life cooperation:
Especially empirical Master's theses are often done in cooperation with private or public sector.

813627S: Master's Thesis Seminar, 2 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Required proficiency level:

ECTS Credits:
1-2 ECTS credits/26-52 hours of work

Language of instruction:
Finnish / English

Timing:
$1^{st} – 2^{nd}$ year of Master's studies, autumn and spring semesters, periods 1-4.

Learning outcomes:
By completing this course the students can plan a scientific study, is capable of presenting own research plan and final draft of own Master's thesis, and understands the approach the reviewers use to evaluate the thesis.

Contents:
See "assessment methods" below.

Mode of delivery:
Mainly face-to-face seminar meetings, if needed telecom meetings are possible.

Learning activities and teaching methods:
Planning and presenting the student's own research. Listening to peers' research plans and research reports.

Target group:

Prerequisites and co-requisites:

"813613S Master's Thesis" course.
Recommended optional programme components:

Recommended or required reading:
 Guidelines to producing a Master's thesis.
Assessment methods and criteria:
Active participation in four (1ECTS) or seven (2ECTS) seminar sessions. One session lasts about 2 hours and they are arranged during the semesters according to the plan published on the website. The students will present their own research plan and the research before official evaluation. During the presentation the research will be discussed critically by an opponent.
Grading:
Pass/fail

Person responsible:
Autumn 2015 Seppo Pahnila
Spring 2016 Raija Halonen and Markku Oivo
Working life cooperation:
No
Other information:

813607S: Maturity test, 0 op

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

815657S: Open Source Software Development, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Henrik Hedberg

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 133 hours of work
Timing:
1 st year of Master's studies, periods 1+2
Learning outcomes:
After passing the course, a student will be able to

- define the historical background and the ideology of Open Source Software (OSS),

- participate in OSS development project,

- evaluate the impact of the usage of OSS and OSS licenses on software development and exploitation, and

- view the phenomenon through the essential scientific research.

Contents:
The course introduces OSS development paradigm and current topics in OSS research. OSS affects both the way to produce software and the decisions of user organizations. It can be understood, for example, from different social, legal, economical, software engineering and data security viewpoints. The aim is to study from different perspectives,

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 on research work.

Mode of delivery:
Mostly face-to-face teaching but some parts are implemented as distance learning
Learning activities and teaching methods:
 Lectures and seminars about 40 h, exercises and peer reviews about 20 h, seminar article and presentation about 70 h
Prerequisites and co-requisites:
Compulsory prerequisites are Bachelor degree or other equivalent degree and basic knowledge on software engineering and research work. The course allows passing Project following the OSS development principles, or writing Master's thesis on a OSS topic.
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; scientific articles covering the topic.
Assessment methods and criteria:
Active participation, seminar article and other assignments
Grading:
1-5
Person responsible:
Henrik Hedberg

817609S: Project Seminar, 3 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Tonja Molin-Juustila

Opintokohteen kielet: English

ECTS Credits:
3 ECTS credits / 70 hours of work
Language of instruction:
English.
Timing:
The timing of this course is dependent on the "Research and Development Project (817612S)" course and will immediately follow the project in the next semester: 2 nd year, period 3.
Learning outcomes:
After completing the course, the students should demonstrate their abilities to work as academic experts in challenging ICT projects. Students will learn to acquire and apply research articles and other new knowledge like an academic expert in a selected topic of their project ("Research and Development Project (817612S)" course). Students will also learn to analyse and report their experience-based new knowledge on the topic to peer students. By completing this course, students are able to act as reflective, independent academic experts in ICT projects and have learnt expertise in some topic area of their project.
As an expert in the selected topic area, the student is able to
-        Search research articles and literature on the topic (review);
-        Report practical experiences gained during the project on the topic;
-        Evaluate the results of the project and reflect the practical experiences against previous literature and research on the topic;
-        Disseminate the (increased) expertise in the topic in a credible way to peers both by a written report and orally.
Contents:
Starting lecture, independent analysis and reporting of the expertise on the selected project topic and an expert seminar (1-2 days) with the presentations of each topic.
Mode of delivery:
Face-to-face teaching during the starting lecture and the seminar, private supervisor for each topic, and web-based learning environment.
Learning activities and teaching methods:
70h per student. Attendance at the starting lecture and the expert seminar is mandatory.
Target group:

Master's level students. Optional for the students of the Master's degree programme on Software, Systems, and Service Development (GS3D).
Prerequisites and co-requisites:
Mandatory: Research and Development Project (817612S) during the previous two periods. This course will immediately follow the project course on the project topics. For the students of the Master's degree programme on Software, Systems, and Service Development (GS3D), Software Factory Project Course (817611S) is mandatory before this course.

Recommended or required reading:
Research articles and material to be collected and studied by the students.
Assessment methods and criteria:
Expertise in the topic area will be reported on the seminar paper. Seminar presentation will also be evaluated. Assessment criteria will be given at the starting lecture and in the web-based learning environment of the course. Read more about assessment criteria at the University of Oulu webpage.
Grading:
Every member of the student group will get the same grade. The grade (scale 1-5) will be based 75% on the expertise in the topic and 25% on the oral presentation.

Person responsible:
Tonja Molin-Juustila
Working life cooperation:
No

817612S: Research and Development Project, 10 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Tonja Molin-Juustila

Opintokohteen kielet: English

ECTS Credits:
10 ECTS credits / 260 hours of work.
Timing:
2 nd year of Master's studies for two periods: periods 1 & 2.
Learning outcomes:
After completing the course, the students should demonstrate their abilities to work on a challenging ICT project. Students will learn to acquire and apply professional expertise in the topic of the project. Students will also demonstrate their skills to conduct an ICT project in a professional way. By completing this course, students are able to act as independent professional members of an ICT project and have advanced professionalism in project work and management. The topics for the course can be anything from the ICT field.
As a professional expert conducting a successful project in a managed way, the student is able to
- Collectively produce, monitor and update the plan of the project (project with fixed time and human resources);
- Search up to date information on the subject matter of the project in order to build professional expertise on the topic and apply this in the project work;
- Build professional working knowledge and skills focused in the subject area of the project (e.g. software development, user experience evaluation);
- Develop analytical and creative skills for successful completion of the project;
- Monitor and communicate the status (time & human resources used) of the project in real time within the project team (weekly/daily meetings);
- Use systematic means (e.g. ICT tools) to enable communication and transparency of the project work;
- Develop skills to communicate with the customer in a professional context;
- Manage a successful project review with the steering group/project team organization; report and explain the status (progress, results and future estimations of the project) to the steering group to support the decision making and problem resolution concerning the project's future;
- Work as responsible project team member; as an expert and/or project manager;
- Work as a project team member with people from different technical and/or cultural backgrounds;
- Produce a realistic outcome in relation to the project time and human resources (ok, good, excellent);
- Reflect the relationship between the process model(s) selected for the project (waterfall, evolutionary, agile etc.) and the management practices followed in the project.

Contents:
Starting lecture, where the steps of carrying out the course will be described together with other important information. Allocation of the project teams will immediately follow the starting lecture. The project work will take two periods (one semester).
Mode of delivery:
Face-to-face teaching at the beginning together with web-based learning environment, mainly project work as collaborative team work, each project group supported with a private supervisor.

Learning activities and teaching methods:
Project work 260h per student. Working hours reported during the project. Attendance at the starting lecture is mandatory.
Target group:
Master's level students.
Prerequisites and co-requisites:
Mandatory: B.Sc. degree or other equivalent degree. Students enrolling directly to the Master's programme should take the "Preparatory course for MSc studies (811392A)" course first (see the timetable for the autumn semester, period 1) or otherwise master the basics of project work and management as in Pressman, R.S. *Software Engineering: A Practitioner's Approach*, the chapters related to project management. The expertise gained during this project course will be further elaborated during the "Project Seminar (817609S)" course, which will immediately follow this course during period 3.

Recommended or required reading:
Unique project material provided by the customer of the project and/or material to be collected and studied by the project team.
Assessment methods and criteria:
Skills will be reported by a project portfolio. Assessment criteria will be given at the starting lecture and they will also be available in the web-based learning environment.

Grading:
1-5
Person responsible:
Tonja Molin-Juustila
Working life cooperation:
Yes. Learning by doing, i.e. managing authentic, resource-limited project work and integrating the practices of an academic expert into the unique project assignment.
Other information:
Enrollment for the course is well beforehand, i.e. until end of July between 1 st and 2 nd study year.

817602S: Software Development in Global Environment, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Similä, Jouni Kalervo

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/135 hours of work.

Language of instruction:
English
Timing:

1 st year of Master's studies, fall semester.
Learning outcomes:
After completing the course, the student

- Can define the key success factors of Global Software Design (GSD) and the potential problems in coordination of projects where teams are separated by physical and/or temporal distance;

- Can define and evaluate the collaborative technologies, which in the best way support distributed software development;
- Can choose the methods and tools for distributed software development;
- Can apply the practices of GSD in a student project and use the supporting tools throughout the project life cycle.

Contents:

Some of the topics covered are strategic issues in distributed development (off-shoring, near-shoring, outsourcing, OSS); cost-benefit-risk analysis; the triad of coordination, control and communication; team building (e.g. virtual teams); software process paradigms in the global environment (planned, agile); methods and tools for distributed software development; issues related to allocation of tasks; communication issues that arise due to distance and time zone differences; infrastructure support; geographical dispersion; lack of information communication; coordination complexity; cultural issues; technical issues related to information and artefact sharing; architectural design; and finally knowledge management issues. The lectures and seminars also review current research aspects of the GSD and related case studies from industry. The exercises demonstrate distributed software development as a virtual team with the support of appropriate methods and tools.

Mode of delivery:

Face-to-face lectures and seminars with all the students. Lecture assignments: reading articles and writing analyses. Communication between exercise groups of 4 students is done over the internet.

Learning activities and teaching methods:

Lectures and seminars involving all the students as well as lecture assignments (reading articles and writing analyses) 70h (20h lecture attendances, 30h lecture assignments, 20h additional reading), and exercises 65h. For lecture assignments each student will read, summarize and analyse selected academic articles. The exercises include laboratory demonstrations of different supporting tools for distributed software development. The students train in project software development and planning practices in a distributed environment. The student project groups are organised into virtual (distributed) teams of 4 students.

Target group:

Obligatory course for students majoring in Software Engineering and GS3D.

Recommended or required reading:

To be announced during the course implementation.

Assessment methods and criteria:

By active participation or alternatively exam, based on the course study materials.

Grading:

1–5, active participation: lectures (25%), lecture assignments (25%), exercises (50%).

Person responsible:

Jouni Similä

Working life cooperation:

No

Other information:

Participation: The course is obligatory for GS ^{3}D students and software engineering students; the total number of students is limited according to the departmental selection rule (valintasääntö, kts. Opinto-opas). 80% attendance is required. Web page **:**

https://noppa.oulu.fi/noppa/kurssi/817602s/etusivu

813613S: Master's Thesis, 30 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Diploma thesis

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

30 ECTS credits/800 hours of work.

Language of instruction:
Finnish/English.

Timing:
Timing is free; execution can be allocated over several semesters. Obligatory for Master's degree. During 1st and 2nd year of Master's studies.
Learning outcomes:
After completing the thesis the student can:

• Define a relevant focused problem in the field of information processing science;
• Apply a scientific method as a tool in solving the stated research problem;
• Synthesise research results and evaluate their validity;
• Write a scientific thesis based on the accomplished research according to the de-partment's guidelines;
• Participate in the evolution of ICT and postgraduate studies after completing the thesis.
Mode of delivery:
Face-to-face meetings and electronic communication with the supervisor.

Learning activities and teaching methods:
Conducting and reporting research under supervision of personal advisor.
Prerequisites and co-requisites:
The research plan and the final draft of the thesis will be presented in the "Master's Thesis Seminar" (813602S).

Assessment methods and criteria:
Read more about assessment criteria at the University of Oulu webpage.
Grading:
The supervisor and a second independent reviewer will evaluate the thesis using the scale 1–5.
Person responsible:
Kari Kuutti

Working life cooperation:
Especially empirical Master's theses are often done in cooperation with private or public sector.

813627S: Master's Thesis Seminar, 2 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Advanced Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

Required proficiency level:

ECTS Credits:
1-2 ECTS credits/26-52 hours of work

Language of instruction:
Finnish / English
Timing:
$1^{st} – 2^{nd}$ year of Master's studies, autumn and spring semesters, periods 1-4.

Learning outcomes:
By completing this course the students can plan a scientific study, is capable of presenting own research plan and final draft of own Master's thesis, and understands the approach the reviewers use to evaluate the thesis.
Contents:

See "assessment methods" below.
Mode of delivery:
Mainly face-to-face seminar meetings, if needed telecom meetings are possible.
Learning activities and teaching methods:
Planning and presenting the student's own research. Listening to peers' research plans and research reports.

Target group:

Prerequisites and co-requisites:
"813613S Master's Thesis" course.
Recommended optional programme components:

Recommended or required reading:
 Guidelines to producing a Master's thesis.
Assessment methods and criteria:
Active participation in four (1ECTS) or seven (2ECTS) seminar sessions. One session lasts about 2 hours and they are arranged during the semesters according to the plan published on the website. The students will present their own research plan and the research before official evaluation. During the presentation the research will be discussed critically by an opponent.
Grading:
Pass/fail

Person responsible:
Autumn 2015 Seppo Pahnila
Spring 2016 Raija Halonen and Markku Oivo
Working life cooperation:
No
Other information:

817609S: Project Seminar, 3 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Tonja Molin-Juustila

Opintokohteen kielet: English

ECTS Credits:
3 ECTS credits / 70 hours of work
Language of instruction:
English.
Timing:
The timing of this course is dependent on the "Research and Development Project (817612S)" course and will immediately follow the project in the next semester: 2 nd year, period 3.
Learning outcomes:
After completing the course, the students should demonstrate their abilities to work as academic experts in challenging ICT projects. Students will learn to acquire and apply research articles and other new knowledge like an academic expert in a selected topic of their project ("Research and Development Project (817612S)" course). Students will also learn to analyse and report their experience-based new knowledge on the topic to peer students. By completing this course, students are able to act as reflective, independent academic experts in ICT projects and have learnt expertise in some topic area of their project.
As an expert in the selected topic area, the student is able to
-        Search research articles and literature on the topic (review);
-        Report practical experiences gained during the project on the topic;
-        Evaluate the results of the project and reflect the practical experiences against previous literature and research on the topic;
-        Disseminate the (increased) expertise in the topic in a credible way to peers both by a written report and orally.
Contents:

Starting lecture, independent analysis and reporting of the expertise on the selected project topic and an expert seminar (1-2 days) with the presentations of each topic.

Mode of delivery:
Face-to-face teaching during the starting lecture and the seminar, private supervisor for each topic, and web-based learning environment.

Learning activities and teaching methods:
70h per student. Attendance at the starting lecture and the expert seminar is mandatory.

Target group:
Master's level students. Optional for the students of the Master's degree programme on Software, Systems, and Service Development (GS3D).

Prerequisites and co-requisites:
Mandatory: Research and Development Project (817612S) during the previous two periods. This course will immediately follow the project course on the project topics. For the students of the Master's degree programme on Software, Systems, and Service Development (GS3D), Software Factory Project Course (817611S) is mandatory before this course.

Recommended or required reading:
Research articles and material to be collected and studied by the students.

Assessment methods and criteria:
Expertise in the topic area will be reported on the seminar paper. Seminar presentation will also be evaluated. Assessment criteria will be given at the starting lecture and in the web-based learning environment of the course. Read more about assessment criteria at the University of Oulu webpage.

Grading:
Every member of the student group will get the same grade. The grade (scale 1-5) will be based 75% on the expertise in the topic and 25% on the oral presentation.

Person responsible:
Tonja Molin-Juustila

Working life cooperation:
No

813621S: Research Methods, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Arto Lanamäki

Opintokohteen kielet: English

Leikkaavuudet:

521146S	Research Methods in Computer Science	5.0 op

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
English

Timing:
The course starts in autumn and continues to spring semester (periods 2 and 3). It is recommended that the course is completed during the first year of Master's studies.

Learning outcomes:
Having completed the course, the student is able to explain the general principles of scientific research and the practices of scientific methodology. The student is also able to generate research problems in information systems and software engineering. The student is able to identify and describe the main research approaches and methods in information systems and software engineering and choose the appropriate approach and method for a research problem. The student is also able to evaluate the methodological quality of a research publication. After the course the student is able to choose and apply the proper approach and method for his or her Master's thesis and find more information on the method from scientific literature.

Contents:
Introduction to general scientific principles, scientific research practices and quality of scientific publications, qualitative research approaches and selected research methods, quantitative research approaches and selected

research methods, design science research and selected methods, requirements and examples of Master's theses, evaluation of research.

Mode of delivery:
Face-to-face teaching and independent studying.

Learning activities and teaching methods:
Lectures 40h, exercises 30h and individual work 65h. Learning diary is written about the lectures and exercises. Exercises include group work.

Target group:

Prerequisites and co-requisites:
Completion of Bachelor's studies

Recommended optional programme components:

Recommended or required reading:
Lecture slides and specified literature

Assessment methods and criteria:
Accepted learning diary

Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail

Person responsible:
Arto Lanamäki
Working life cooperation:
No
Other information:
-

817612S: Research and Development Project, 10 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Tonja Molin-Juustila

Opintokohteen kielet: English

ECTS Credits:
10 ECTS credits / 260 hours of work.
Timing:
2 nd year of Master's studies for two periods: periods 1 & 2.
Learning outcomes:
After completing the course, the students should demonstrate their abilities to work on a challenging ICT project. Students will learn to acquire and apply professional expertise in the topic of the project. Students will also demonstrate their skills to conduct an ICT project in a professional way. By completing this course, students are able to act as independent professional members of an ICT project and have advanced professionalism in project work and management. The topics for the course can be anything from the ICT field.
As a professional expert conducting a successful project in a managed way, the student is able to
-      Collectively produce, monitor and update the plan of the project (project with fixed time and human resources);
-      Search up to date information on the subject matter of the project in order to build professional expertise on the topic and apply this in the project work;
-      Build professional working knowledge and skills focused in the subject area of the project (e.g. software development, user experience evaluation);
-      Develop analytical and creative skills for successful completion of the project;

- Monitor and communicate the status (time & human resources used) of the project in real time within the project team (weekly/daily meetings);
- Use systematic means (e.g. ICT tools) to enable communication and transparency of the project work;
- Develop skills to communicate with the customer in a professional context;
- Manage a successful project review with the steering group/project team organization; report and explain the status (progress, results and future estimations of the project) to the steering group to support the decision making and problem resolution concerning the project's future;
- Work as responsible project team member; as an expert and/or project manager;
- Work as a project team member with people from different technical and/or cultural backgrounds;
- Produce a realistic outcome in relation to the project time and human resources (ok, good, excellent);
- Reflect the relationship between the process model(s) selected for the project (waterfall, evolutionary, agile etc.) and the management practices followed in the project.

Contents:
Starting lecture, where the steps of carrying out the course will be described together with other important information. Allocation of the project teams will immediately follow the starting lecture. The project work will take two periods (one semester).

Mode of delivery:
Face-to-face teaching at the beginning together with web-based learning environment, mainly project work as collaborative team work, each project group supported with a private supervisor.

Learning activities and teaching methods:
Project work 260h per student. Working hours reported during the project. Attendance at the starting lecture is mandatory.

Target group:
Master's level students.

Prerequisites and co-requisites:
Mandatory: B.Sc. degree or other equivalent degree. Students enrolling directly to the Master's programme should take the "Preparatory course for MSc studies (811392A)" course first (see the timetable for the autumn semester, period 1) or otherwise master the basics of project work and management as in Pressman, R.S. *Software Engineering: A Practitioner's Approach*, the chapters related to project management. The expertise gained during this project course will be further elaborated during the "Project Seminar (817609S)" course, which will immediately follow this course during period 3.

Recommended or required reading:
Unique project material provided by the customer of the project and/or material to be collected and studied by the project team.

Assessment methods and criteria:
Skills will be reported by a project portfolio. Assessment criteria will be given at the starting lecture and they will also be available in the web-based learning environment.

Grading:
1-5

Person responsible:
Tonja Molin-Juustila

Working life cooperation:
Yes. Learning by doing, i.e. managing authentic, resource-limited project work and integrating the practices of an academic expert into the unique project assignment.

Other information:
Enrollment for the course is well beforehand, i.e. until end of July between 1 st and 2 nd study year.

815303A: Embedded Software Development Environments, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Juustila, Antti Juhani

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 133 hours of work

Timing:
1 st year of Master's and GS 3D studies, spring semester, period 4
Learning outcomes:
After completing the course, a student is able to work with the essential software development tools of a selected embedded platform. The student is able to implement memory and power efficient applications by exploiting existing libraries and knowledge of the programming interfaces provided by the platform.
Contents:
The focus of the course is in the software development environments and tools for mobile and embedded platforms, such as Android, iOS, and Windows Phone. In addition, the course covers memory and power management, core services of the platform, and the utilisation of existing libraries. One platform will be selected for deeper study, and the course introduces its essential software development tools and libraries. The emphasis is on application development for the platform as an exercise.
Mode of delivery:
Blended teaching
Learning activities and teaching methods:
Lectures and exercises about 40 h, exercises and exercise work 93 h
Prerequisites and co-requisites:
Course "815309A Real-time Distributed Software Development", C/C++ and/or Java programming skills or similar knowledge obtained from other courses.
Recommended or required reading:
Course material, the documentation of selected technologies, and other related literature
Assessment methods and criteria:
Exercise work
Grading:
1-5
Person responsible:
Antti Juustila

815657S: Open Source Software Development, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Henrik Hedberg

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 133 hours of work
Timing:
1 st year of Master's studies, periods 1+2
Learning outcomes:
After passing the course, a student will be able to

- define the historical background and the ideology of Open Source Software (OSS),

- participate in OSS development project,

- evaluate the impact of the usage of OSS and OSS licenses on software development and exploitation, and

- view the phenomenon through the essential scientific research.

Contents:
The course introduces OSS development paradigm and current topics in OSS research. OSS affects both the way to produce software and the decisions of user organizations. It can be understood, for example, from different social, legal, economical, software engineering and data security viewpoints. The aim is to study from different perspectives, 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 on research work.

Mode of delivery:
Mostly face-to-face teaching but some parts are implemented as distance learning

Learning activities and teaching methods:
Lectures and seminars about 40 h, exercises and peer reviews about 20 h, seminar article and presentation about 70 h

Prerequisites and co-requisites:
Compulsory prerequisites are Bachelor degree or other equivalent degree and basic knowledge on software engineering and research work. The course allows passing Project following the OSS development principles, or writing Master's thesis on a OSS topic.

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; scientific articles covering the topic.

Assessment methods and criteria:
Active participation, seminar article and other assignments

Grading:
1-5

Person responsible:
Henrik Hedberg

815305A: Real Time Distributed Software Development, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Petri Pulli

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/135 hours of work

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. Interrupts

Characteristics of Distribution
1. Distribution architectures
2. Concept of time;
3. Synchronisation;
4. Latency and jitter;
5. Quality of service;
6. Service discovery;
7. Networking primitives

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 40h, design exercises 15h, student project 80h.
Prerequisites and co-requisites:
Student understands computer architecture, object-oriented analysis and design (UML), programming language C and/or Java.
Recommended or required reading:
Lecture notes based on reference books
 • 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
Grading:
1-5
Person responsible:
Petri Pulli

817602S: Software Development in Global Environment, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Similä, Jouni Kalervo

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/135 hours of work.

Language of instruction:
English
Timing:

1 st year of Master's studies, fall semester.
Learning outcomes:
After completing the course, the student

 • Can define the key success factors of Global Software Design (GSD) and the potential problems in coordination of projects where teams are separated by physical and/or temporal distance;
 • Can define and evaluate the collaborative technologies, which in the best way support distributed software development;
 • Can choose the methods and tools for distributed software development;
 • Can apply the practices of GSD in a student project and use the supporting tools throughout the project life cycle.
Contents:
Some of the topics covered are strategic issues in distributed development (off-shoring, near-shoring, outsourcing, OSS); cost-benefit-risk analysis; the triad of coordination, control and communication; team building (e.g. virtual teams); software process paradigms in the global environment (planned, agile); methods and tools for distributed software development; issues related to allocation of tasks; communication issues that arise due to distance and time zone differences; infrastructure support; geographical dispersion; lack of information communication; coordination complexity; cultural issues; technical issues related to information and artefact sharing; architectural design; and finally knowledge management issues. The lectures and seminars also review current research aspects of the GSD and related case studies from industry. The exercises demonstrate distributed software development as a virtual team with the support of appropriate methods and tools.

Mode of delivery:
 Face-to-face lectures and seminars with all the students. Lecture assignments: reading articles and writing analyses. Communication between exercise groups of 4 students is done over the internet.

Learning activities and teaching methods:
Lectures and seminars involving all the students as well as lecture assignments (reading articles and writing analyses) 70h (20h lecture attendances, 30h lecture assignments, 20h additional reading), and exercises 65h. For lecture assignments each student will read, summarize and analyse selected academic articles. The exercises include laboratory demonstrations of different supporting tools for distributed software development. The students train in project software development and planning practices in a distributed environment. The student project groups are organised into virtual (distributed) teams of 4 students.

Target group:
Obligatory course for students majoring in Software Engineering and GS3D.

Recommended or required reading:
To be announced during the course implementation.

Assessment methods and criteria:
By active participation or alternatively exam, based on the course study materials.

Grading:
1–5, active participation: lectures (25%), lecture assignments (25%), exercises (50%).

Person responsible:
Jouni Similä

Working life cooperation:
No

Other information:
 Participation: The course is obligatory for GS ^{3}D students and software engineering students; the total number of students is limited according to the departmental selection rule (valintasääntö, kts. Opinto-opas). 80% attendance is required. Web page **:**
https://noppa.oulu.fi/noppa/kurssi/817602s/etusivu

815662S: Software Engineering Management, Measurement and Improvement, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Oivo, Markku Tapani

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work

Timing:
2 nd year of Master's and GS ^{3}D studies, autumn semester, period 2

Learning outcomes:
After completing the course the student understands the fundamental principles of software processes and their development in professional software engineering. The course extends the quality understanding based on individual techniques (e.g. reviews) so that after completing the course the student is able to:

- Evaluate different methods and techniques;
- Select from them appropriate ones for different software engineering environments;
- Have capabilities to participate in systematic efforts for improvement in software companies.

Contents:
The course covers the most fundamental process centred software quality improvement and management approaches, methods and latest research results, as well as approaches to software measurement. The topics of the course include: traditional waterfall, agile (extreme programming, scrum, rational unified process, crystal, feature driven development, adaptive software development, dynamic systems development method) and lean methods, process improvement approaches, software process and product measurement, agile and lean practices, process improvement at the enterprise level and practical examples from software industry.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 18h, study group working 25h, paper reading 25h, seminar 20h, report writing 20h
Prerequisites and co-requisites:
 B.Sc. or other equivalent degree and basic knowledge of software engineering
Recommended or required reading:
- CMMI: Guidelines for Process Integration and Product Improvement. Mary Beth Chrissis, Mike Konrad, Sandy Shrum. Addison-Wesley, ISBN 032-115496-7, 2004.
- Agile Project Management with Scrum. Ken Schwaber, Microsoft Press, ISBN 0-7356-1993-X. 2004.
- Dingsøyr T., Dybå T., Moe N.B., Agile Software Development: Current Research and Future Directions, Springer, 2010
- C. Jones, Applied Software Measurement: Global Analysis of Productivity and Quality, 3rd ed. McGraw-Hill Osborne Media, 2008.
- Craig Larman and Bas Vodde, Scaling Lean & Agile Development: Thinking and Organizational Tools for Large-Scale Scrum, Addison-Wesley, 2009

Assessment methods and criteria:
Active and regular participation to lectures and seminars AND report evaluation AND seminar presentations
Grading:
1-5
Person responsible:
Markku Oivo

815663S: Software Engineering Research, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Burak Turhan

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/132 hours of work
Timing:
2 nd year of Master's studies, autumn semester, period 1+2

Learning outcomes:
After completing the course the student will know the current research areas in software engineering and the most important software engineering research methods. The student understands academic research and publishing in software engineering, and is able to critically analyse scientific articles from the viewpoint of the content and research methods used in the article. The student is able to present academic research and actively participate in an academic discussion of research papers and research results.
Contents:
Empirical research methods for software engineering: experiments, case studies, surveys, systematic literature reviews and replications in software engineering. Research topics in empirical software engineering.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures and seminars 33h, assignments and paper reading 33h, weekly study 66h.
Prerequisites and co-requisites:
B.Sc. or other equivalent degree
Recommended or required reading:
- Wohlin C., Runeson P., Höst M., Ohlsson M., Regnell B., Wesslen A., Experimentation in Software Engineering, Springer, 2012,.
- Per Runeson, Martin Host, Austen Rainer, Bjorn Regnell: Case Study Research in Software Engineering: Guidelines and Examples, Wiley, 2012.

Assessment methods and criteria:
Active and regular attendance (mandatory) to lectures and seminars.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:
Burak Turhan
Other information:
It is not possible to complete the course remotely or with self-study options.

815312A: Software Production and Maintenance, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Saukkonen, Samuli

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/133 hours of work
Timing:
1 [st] year of Master's and GS [3]D studies, spring semester, period 3
Learning outcomes:
After completing the course, the student:

- Can apply the framework of product line engineering in large scale software production;
- Can apply the maintenance process and techniques in software production.

Contents:
Product line engineering
1. Product line variability;
2. Domain engineering;
3. Application engineering;
4. Transition strategies and organisational issues.
Software maintenance
1. Categories of maintenance;
2. Corrective maintenance;
3. Other forms of maintenance.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 20h, study group working and weekly discussion sessions with the teacher on 8 assignments, together with report writing, 113h.
Prerequisites and co-requisites:
 Basic knowledge of software engineering and software architectures.
Recommended or required reading:
- Pohl, K., Böckle, G., van der Linden, F. Software Product Line Engineering. Foundations, Principles, and Techniques, Springer-Verlag, 2005; chapters 1-5, 10, 15, 19-20.
- Chastek G.J., Donohoe P., McGregor J.D., Formulation of a Production Strategy for a Software Product Line, Technical Note CMU/SEI-2009-TN-025, Carnegie Mellon, 2009
- Gopalaswamy, R., Ramesh, B., Software maintenance: effective practices for geographically distributed environments, Tata McGraw-Hill, 2006 - Computers - 456 pages; chapters 1-6.

Assessment methods and criteria:
 Active participation: 8 weekly assignments to be assessed separately. The final grade will be the sum of all assignments. "Conventional" participation: written exam.
Grading:
1-5
Person responsible:
Samuli Saukkonen

815311A: Software Quality and Testing, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Burak Turhan

Opintokohteen kielet: English

Leikkaavuudet:

   ay815311A   Software Quality and Testing (OPEN UNI)   5.0 op

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
 1 st year of Master's studies, autumn semester, period 1
Learning outcomes:
The student understands different views on software quality and the role of reviews, inspection and testing as a part of software engineering and defect removal techniques. The student can conduct the review as part of review team and use an appropriate supporting tool. The student knows testing levels, strategies and techniques, can create test cases and conduct unit testing with appropriate testing tools. The student knows the possibilities of test driven development, test automation and models for reviewing.
Contents:
Software quality and quality assurance. Software reviews and inspection. Fundamental concepts of software testing. Software testing techniques. Test-driven development. Test automation.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 32h, study group working 24h, paper reading 24h, exercises 24h, report writing 30 h
Target group:

Prerequisites and co-requisites:
Basic knowledge of software engineering, knowledge of Java programming language.
Recommended optional programme components:

Recommended or required reading:
To be announced during the course implementation but initially planned to be:
• Pezze M.,Young M., "Software Testing and Analysis: Process, Principles and Tech-niques", John Wiley&Sons, 2008
• A. P. Mathur, "Foundations of Software Testing", Prentice Hall, 2008
• Paul Ammann, Jeff Offutt, "Introduction to Software Testing", Cambridge University Press, 2008
• Kent Beck, "Test-Driven Development by Example", Addison-Wesley, 2002
• Lasse Koskela, "Test Driven: Practical TDD and Acceptance TDD for Java Devel-opers", Manning Publications, 2007
• Galin D., "Software Quality Assurance: From theory to implementation", Addison-Wesley, 2004
Assessment methods and criteria:
Report and exercise evaluation, active and regular attendance to lectures and exercises.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1–5
Person responsible:
 Burak Turhan
Working life cooperation:
No

813626S: Emerging Technologies and Issues, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
1 st year of Master's and GS 3D studies, autumn semester, period 2
Learning outcomes:
 After completing the course, the student is able to **:**

- Analyse the on-going changes in online and consumer behaviour, customer requirements, ICT markets and technological development;
- Evaluate key enabling web technologies and become an effective participant in web-enabled business endeavours and initiatives;
- Design ways for leveraging information and communication technologies to improve intra- and inter-organisational processes and enhance a firm's competitive position;
- Plan ways for searching innovations; and
- Develop his/her skills for building careers and taking advantage of entrepreneurial opportunities through emerging technologies, in particular related to the web.

Contents:
1. A shift in thinking about the web and emerging technologies
2. How to social web is transforming businesses, software design, our perception of people as well as skills required of us
3. How to accelerate innovation creation through web-based and other emerging technologies: Ecosystem thinking, strategies, core business values
4. Transformation of the social web into humanized web

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 24h, reflective personal exercises 30h, independent work (required reading) 80h.

Target group:

Prerequisites and co-requisites:
None
Recommended optional programme components:

Recommended or required reading:
Oinas-Kukkonen Harri & Oinas-Kukkonen Henry (2013) Humanizing the Web: Change and Social Innovation. Palmgrave Macmillan, Basingstoke, UK (required reading).

Assessment methods and criteria:
Exam (only in English)

Grading:
1–5
Person responsible:
Harri Oinas-Kukkonen
Working life cooperation:
No

812351A: Enterprise Systems, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Li Zhao
Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
1st year of Master's and GS3D studies, spring semester, period 3

Learning outcomes:
After completing the course, the student:

- Understands how ERP, SCM, KM, CRM, global supply chain, inventory management, and online business systems operate;
- Understands how business processes integrate the internal functions of the enterprise and allow the enterprise to interact with its business environment (such as suppliers, business partners, and customers);
- Is able to recognize, model, and improve business processes to help enterprises achieve efficiency, effectiveness, and competitive advantage;
- Understands how to do research on enterprise information systems.

Contents:
1. Principles of enterprise systems, and business processes that integrate the internal functions of the enterprise and connect the enterprise with its business environment;
2. Manage enterprises' intellectual capital to achieve competitive advantage;
3. Enterprise resource planning (ERP);
4. Supply chain management (SCM);
5. Global supply chain & inventory management systems
6. Knowledge management systems;
7. Customer relationship management (CRM);
8. Internet-based Business and Marketing Systems;
9. Enterprise application integration (EAI)

Learning activities and teaching methods:
The overall workload for each student in this course is 134 hours. Lectures (24h), exercises (16h), homework (25h), essay (35 h), examination (34h)
Target group:

Prerequisites and co-requisites:
Understanding of the business process modeling helps.

Recommended optional programme components:

Recommended or required reading:
Refer to the course webpages
Assessment methods and criteria:
Exercises, assignments, essay, and examination.

Grading:
1–5
Person responsible:
Li Zhao
Working life cooperation:
No

Compulsory

812351A-01: Enterprise Systems, exercise work, 0 op

Opiskelumuoto: Intermediate Studies
Laji: Partial credit
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

Ei opintojaksokuvauksia.

812351A-02: Enterprise Systems, exam, 0 op

Opiskelumuoto: Intermediate Studies
Laji: Partial credit
Arvostelu: 1 - 5, pass, fail
Opettajat: Li Zhao
Opintokohteen kielet: English

Ei opintojaksokuvauksia.

817604S: ICT and Organizational Change, 5 op

Voimassaolo: 01.08.2010 -
Opiskelumuoto: Advanced Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Minna Isomursu
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
2nd year, autumn semester, periods 1+2
Learning outcomes:
After completing the course the student is:

- Able to distinguish various levels of organisational activities and their relations;
- Able to discuss about the role of information technology in various levels of change of organisation and its context;
- Able to analyse ICT-based organizational change process.

Contents:
The course studies organisations at four levels: individuals, practices, organizational structures and transformations, and the societal context of organisations. The organizational role of ICT and the relation between ICT and knowledge are also discussed. A method for analysing organisations as networks of activity systems is presented. The role of power, trust and control in the change process is discussed. The different aspects of change agents are presented and analysed.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Introductory lectures 20h, seminar sessions 14h, individual work 100h (for a review and analysis of selected course materials and making a presentation for the seminar).
Prerequisites and co-requisites:
B.Sc. or other equivalent degree and course Information Systems in Organisations (812304A) or equivalent knowledge.

Recommended optional programme components:

Recommended or required reading:
A list of research articles will be provided for the lectures and assignments. Readings for the background and theoretical framework are:
- Gareth R. Jones (2010) Organizational Theory, Design, and Change: Global Edition (6. Ed.) Chapters 1-3, 10-12, Prentice Hall.
- K. Kuutti (1996) Activity Theory as a potential framework for human-computer inter-action research, in Context and Consciousness: Activity Theory and Human Com-puter Interaction, B. Nardi, Editor. 1996, MIT Press: Cambridge. p. 17-44.
- Frank Blackler (1995) Knowledge, knowledge work and organizations: an overview and interpretation.

Organization studies, 1995. Pp. 1021-1046
- Frank Blackler et al. (2000) Organizing Processes in Complex Activity Networks. Organization, vol. 7 no. 2. Pp. 277-300.

Assessment methods and criteria:
Lecture and seminar participation, assignment (literature review, analysis, seminar presentation). Alternatively by examination and personal assignment report.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1-5
Person responsible:
Minna Isomursu
Working life cooperation:
No

812349A: IT Infrastructure, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Katja Leiviskä

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
English
Timing:
1st year of Master's studies, spring semester, period 4

Learning outcomes:
After completing the course, students are able to judge, compare and apply data communications concepts to various situations encountered in industry; identify general concepts and techniques of data communications; explain the technology of the Internet; identify the most important server and storage architectures and the main mechanisms for providing high-capacity processing and storage capacity; and explain the regulatory environ-ment.
Contents:
1. Introduction to large-scale computing applications;
2. Network requirements and architecture;
3. Standards and standards bodies;
4. Network services and Middleware;
5. Internet services, protocols and technologies;
6. Underlying network technologies;
7. Performance monitoring, fault detection, recovery and restoration;
8. Next-generation network infrastructure, industry technology directions.
Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (24 h), student project work (90 h) and examination (20 h).
Target group:

Prerequisites and co-requisites:
Student is familiar with basic computer architecture and the Internet.
Recommended optional programme components:

Recommended or required reading:
- Lecture notes;
- Supplementary technical and scientific articles;
- Phil Simon (2010) The next wave of technologies: opportunities from chaos. Wiley. ISBN 0-47-058750-4.

Reference books:
- Comer, D.E. (2009) Computer Networks and Internets. 5th edition. Pearson ISBN 0-13-504583-5. 600 p.
- Kurose J.F., Ross K.W. (2010) Computer Networking – A Top-Down Approach. 5th edition. Pearson ISBN 0-13-136548-7. 888 p.
- Travostino F., Mambretti J., Karmous-Edwards G. (2006) Grid Networks – Enabling grids with advanced communication technology. Wiley ISBN 0-470-01748-1. 340 p.

Assessment methods and criteria:
Individual project work, examination
Read more about assessment criteria at the University of Oulu webpage.
Grading:
 1–5
Person responsible:
 Anssi Öörni
Working life cooperation:
No

813623S: Information Security Policy and Management in Organisations, 5 op

Voimassaolo: 01.08.1950 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Pahnila, Petri Puhakainen

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
2nd year of Master's and GS3D studies, autumn semester, period 2 + 3

Learning outcomes:
After completing the course, the student is able to:

- Develop BPC;
- Develop organisation specific information security policies and sub-policy systems in organisations;
- Improve employees' compliance with the information security procedures through training, campaigning and other measures;
- Carry out risk management in practice;
- Estimate the economical investment in information security;
- Understand the strengths and weaknesses of information security management stan-dards;
- Understand the certifications in the area of information security management;
- Design information security policies at organisations.
Contents:
1. BCP;
2. Development of organisation specific information security policies and sub-policy systems at organisations;
3. Measuring employees' compliance with information security policies;
4. Improving employees' compliance with the information security procedures through training, campaigning and other means;
5. Information security risk management in practice, estimation of economical investment in information security;
6. Information security management standards;
7. Certifications related to information security.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 30h, exercises 18h, student preparation and reading for exercises and examination 86h.
Target group:

Prerequisites and co-requisites:

Bachelor degree or other equivalent degree and course "811168P Introduction to Information Security" or principles of information security, or similar knowledge obtained from other courses.
Recommended optional programme components:

Recommended or required reading:
Articles (to be announced later)
Assessment methods and criteria:
Examination.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1–5
Person responsible:
Petri Puhakainen ja Seppo Pahnila
Working life cooperation:
No

813625S: Information Systems Theory, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 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 (40.5 hours of work), class preparation 1.5 ECTS (40.5 hours of work), and exercises 2 ECTS (53 hours of work).

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, class quizzes, and research essay are assessed. Note that there is no final exam.
Grading:
1–5
Person responsible:
Netta Iivari
Working life cooperation:
No
Other information:
Course material can be found at OPTIMA e-learning environment, Urkund is used for course work submissions.

812331A: Interaction Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Netta Iivari

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/133 hours of work
Language of instruction:
English
Timing:
1st year of Master's studies, autumn semester period 1
Learning outcomes:
Objective: The course explains the role of human interaction with IT products, systems, and services, explains the factors and problems related to it to motivate interaction design, and teaches some user-centered methods for analysis, evaluation and design of interactions.
Learning Outcomes: After completing the course, the student can assess the role of human interaction with IT products, systems, and 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 and user experience for user interface design;
- use interaction design methods in designing for target user experiences.
Contents:
The course provides an overview of interaction design, introducing the terminology and fundamental concepts, the main activities, and the importance of user involvement in the design process. The course addresses establishing requirements for IT products, systems, and services. The focus is on usability and user experience from the viewpoint of the intended users, their tasks and the context of use. The course covers user-centered methods for designing for and evaluating usability and user experience of IT products, systems, and services. All the main activities of interaction design are carried out in a practical design case.
Mode of delivery:
Face-to-face teaching, self-study
Learning activities and teaching methods:
Lectures (20 h), exercises and seminar (25 h), individual and group assignments (88 h), or self-study: an opening lecture (2 h), one larger assignment (110 h) and individual tasks (21 h).
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:
Rogers, Sharp and Preece (2011, 3rd edition) *Interaction Design: Beyond Human-Computer Interaction* and related lecture and assignment materials
Assessment methods and criteria:
Accepted assignments and individual tasks

Grading:
1-5
Person responsible:
Netta Iivari
Working life cooperation:
No

817603S: System Design Methods for Information Systems, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

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

817610S: Doing Software Business in China, 5 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Marianne Kinnula, Xiaosong Zheng

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
1 st – 2 nd year, spring semester, period 4

Learning outcomes:
After completion of the course, students will have a comprehensive understanding of software as a business and an industry in China. Students will recognise success factors, business models and development trends of the software business in China. Students will also understand the special characteristics of the software business in China.
Contents:
In the course a number of software business topics will be covered and these include: the current software market in China; software products and services in China; internationalisation and globalisation; revenue generation concepts; business planning in China; financing, pricing, cost and profitability; offer calculation; software engineering processes, and business project and entrepreneurship in China.

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 20h, assignment 60h, and exam 54. In the lectures much of the time will be devoted to discussing specific topics in small groups and among the class as a whole. In addition, case studies, home assignments and in-class presentation will be used. For the home assignment students are required to form a group (2 students per group) to complete a written report on a specific software business topic.
Recommended or required reading:
There is no prescribed textbook for this course. Instead, a reading brick comprising lecture notes, book chapters, journal articles and case studies relating to the various topics being covered will be made available for downloading.
Assessment methods and criteria:
1) Exam (50%), 2) home assignment and in-class presentation (50%).
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1-5
Person responsible:
Xiaosong Zheng ja Marianne Kinnula
Working life cooperation:
No

815657S: Open Source Software Development, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Henrik Hedberg

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 133 hours of work
Timing:
1 st year of Master's studies, periods 1+2
Learning outcomes:
After passing the course, a student will be able to

- define the historical background and the ideology of Open Source Software (OSS),

- participate in OSS development project,

- evaluate the impact of the usage of OSS and OSS licenses on software development and exploitation, and

- view the phenomenon through the essential scientific research.

Contents:
The course introduces OSS development paradigm and current topics in OSS research. OSS affects both the way to produce software and the decisions of user organizations. It can be understood, for example, from different social, legal, economical, software engineering and data security viewpoints. The aim is to study from different perspectives, 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 on research work.

Mode of delivery:
Mostly face-to-face teaching but some parts are implemented as distance learning
Learning activities and teaching methods:
 Lectures and seminars about 40 h, exercises and peer reviews about 20 h, seminar article and presentation about 70 h
Prerequisites and co-requisites:
Compulsory prerequisites are Bachelor degree or other equivalent degree and basic knowledge on software engineering and research work. The course allows passing Project following the OSS development principles, or writing Master's thesis on a OSS topic.
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; scientific articles covering the topic.
Assessment methods and criteria:
Active participation, seminar article and other assignments
Grading:
1-5
Person responsible:
Henrik Hedberg

815305A: Real Time Distributed Software Development, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Petri Pulli

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/135 hours of work

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. Interrupts

Characteristics of Distribution
1. Distribution architectures
2. Concept of time;
3. Synchronisation;
4. Latency and jitter;
5. Quality of service;
6. Service discovery;
7. Networking primitives

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 40h, design exercises 15h, student project 80h.

Prerequisites and co-requisites:
Student understands computer architecture, object-oriented analysis and design (UML), programming language C and/or Java.

Recommended or required reading:
Lecture notes based on reference books
- 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

Grading:
1-5

Person responsible:
Petri Pulli

814340A: Small-Group Tutoring, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Leena Ventä-Olkkonen

Opintokohteen kielet: Finnish

ECTS Credits:
3 ECTS credits/80 hours of work

Language of instruction:
Finnish
Timing:
2 nd – 5 th year, autumn and spring semester, periods 1–4

Learning outcomes:
After passing the course a student (tutor) is able to:

- Draw up a supervision plan for his/her small group;
- Put into effect his/her supervision from the viewpoint of students and based on the given tutor training;
- Receive supervision and guidance experience;
- Take responsibility for his/her own supervision work.

Contents:
1. Group training, occasions and meetings 25h
2. Planning and implementation of small-group tutoring 53h
3. Writing his/her own report diary 2h.

Mode of delivery:
Face-to-face teaching and web-based teaching.
Learning activities and teaching methods:
Lectures, exercises and meetings. Practice as a small-group tutor in co-operation with other tutors, Blanko student organisation, library and own department's study-counsellors. Independent personal work.
Recommended or required reading:
Training materials, forms and own reports.
Assessment methods and criteria:
Active participation in tutor-training, implementing small-group tutoring and drawing up the supervision plan and the report diary.

Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail

Person responsible:
Leena Venntä-Olkkonen
Working life cooperation:
No

817602S: Software Development in Global Environment, 5 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Similä, Jouni Kalervo
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/135 hours of work.

Language of instruction:
English
Timing:

1 st year of Master's studies, fall semester.
Learning outcomes:
After completing the course, the student

- Can define the key success factors of Global Software Design (GSD) and the potential problems in coordination of projects where teams are separated by physical and/or temporal distance;
- Can define and evaluate the collaborative technologies, which in the best way support distributed software development;
- Can choose the methods and tools for distributed software development;

- Can apply the practices of GSD in a student project and use the supporting tools throughout the project life cycle.

Contents:
Some of the topics covered are strategic issues in distributed development (off-shoring, near-shoring, outsourcing, OSS); cost-benefit-risk analysis; the triad of coordination, control and communication; team building (e.g. virtual teams); software process paradigms in the global environment (planned, agile); methods and tools for distributed software development; issues related to allocation of tasks; communication issues that arise due to distance and time zone differences; infrastructure support; geographical dispersion; lack of information communication; coordination complexity; cultural issues; technical issues related to information and artefact sharing; architectural design; and finally knowledge management issues. The lectures and seminars also review current research aspects of the GSD and related case studies from industry. The exercises demonstrate distributed software development as a virtual team with the support of appropriate methods and tools.

Mode of delivery:
Face-to-face lectures and seminars with all the students. Lecture assignments: reading articles and writing analyses. Communication between exercise groups of 4 students is done over the internet.

Learning activities and teaching methods:
Lectures and seminars involving all the students as well as lecture assignments (reading articles and writing analyses) 70h (20h lecture attendances, 30h lecture assignments, 20h additional reading), and exercises 65h. For lecture assignments each student will read, summarize and analyse selected academic articles. The exercises include laboratory demonstrations of different supporting tools for distributed software development. The students train in project software development and planning practices in a distributed environment. The student project groups are organised into virtual (distributed) teams of 4 students.

Target group:
Obligatory course for students majoring in Software Engineering and GS3D.

Recommended or required reading:
To be announced during the course implementation.

Assessment methods and criteria:
By active participation or alternatively exam, based on the course study materials.

Grading:
1–5, active participation: lectures (25%), lecture assignments (25%), exercises (50%).

Person responsible:
Jouni Similä

Working life cooperation:
No

Other information:
Participation: The course is obligatory for GS ^{3}D students and software engineering students; the total number of students is limited according to the departmental selection rule (valintasääntö, kts. Opinto-opas). 80% attendance is required. Web page **:**
https://noppa.oulu.fi/noppa/kurssi/817602s/etusivu

815662S: Software Engineering Management, Measurement and Improvement, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Oivo, Markku Tapani

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work

Timing:
2 nd year of Master's and GS ^{3}D studies, autumn semester, period 2

Learning outcomes:
After completing the course the student understands the fundamental principles of software processes and their development in professional software engineering. The course extends the quality understanding based on individual techniques (e.g. reviews) so that after completing the course the student is able to:

- Evaluate different methods and techniques;
- Select from them appropriate ones for different software engineering environments;
- Have capabilities to participate in systematic efforts for improvement in software companies.

Contents:
The course covers the most fundamental process centred software quality improvement and management approaches, methods and latest research results, as well as approaches to software measurement. The topics of the course include: traditional waterfall, agile (extreme programming, scrum, rational unified process, crystal, feature driven development, adaptive software development, dynamic systems development method) and lean methods, process improvement approaches, software process and product measurement, agile and lean practices, process improvement at the enterprise level and practical examples from software industry.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 18h, study group working 25h, paper reading 25h, seminar 20h, report writing 20h
Prerequisites and co-requisites:
 B.Sc. or other equivalent degree and basic knowledge of software engineering
Recommended or required reading:
- CMMI: Guidelines for Process Integration and Product Improvement. Mary Beth Chrissis, Mike Konrad, Sandy Shrum. Addison-Wesley, ISBN 032-115496-7, 2004.
- Agile Project Management with Scrum. Ken Schwaber, Microsoft Press, ISBN 0-7356-1993-X. 2004.
- Dingsøyr T., Dybå T., Moe N.B., Agile Software Development: Current Research and Future Directions, Springer, 2010
- C. Jones, Applied Software Measurement: Global Analysis of Productivity and Quality, 3rd ed. McGraw-Hill Osborne Media, 2008.
- Craig Larman and Bas Vodde, Scaling Lean & Agile Development: Thinking and Organizational Tools for Large-Scale Scrum, Addison-Wesley, 2009

Assessment methods and criteria:
Active and regular participation to lectures and seminars AND report evaluation AND seminar presentations
Grading:
1-5
Person responsible:
Markku Oivo

815312A: Software Production and Maintenance, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Saukkonen, Samuli

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/133 hours of work
Timing:
1 st year of Master's and GS ^{3}D studies, spring semester, period 3
Learning outcomes:
After completing the course, the student:

- Can apply the framework of product line engineering in large scale software production;
- Can apply the maintenance process and techniques in software production.

Contents:
Product line engineering
1. Product line variability;

2. Domain engineering;
3. Application engineering;
4. Transition strategies and organisational issues.

Software maintenance
1. Categories of maintenance;
2. Corrective maintenance;
3. Other forms of maintenance.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 20h, study group working and weekly discussion sessions with the teacher on 8 assignments, together with report writing, 113h.

Prerequisites and co-requisites:
 Basic knowledge of software engineering and software architectures.

Recommended or required reading:
- Pohl, K., Böckle, G., van der Linden, F. Software Product Line Engineering. Foundations, Principles, and Techniques, Springer-Verlag, 2005; chapters 1-5, 10, 15, 19-20.
- Chastek G.J., Donohoe P., McGregor J.D., Formulation of a Production Strategy for a Software Product Line, Technical Note CMU/SEI-2009-TN-025, Carnegie Mellon, 2009
- Gopalaswamy, R., Ramesh, B., Software maintenance: effective practices for geographically distributed environments, Tata McGraw-Hill, 2006 - Computers - 456 pages; chapters 1-6.

Assessment methods and criteria:
 Active participation: 8 weekly assignments to be assessed separately. The final grade will be the sum of all assignments. "Conventional" participation: written exam.

Grading:
1-5

Person responsible:
Samuli Saukkonen

815311A: Software Quality and Testing, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Burak Turhan

Opintokohteen kielet: English

Leikkaavuudet:

ay815311A   Software Quality and Testing (OPEN UNI)   5.0 op

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
English

Timing:
 1 st year of Master's studies, autumn semester, period 1

Learning outcomes:
The student understands different views on software quality and the role of reviews, inspection and testing as a part of software engineering and defect removal techniques. The student can conduct the review as part of review team and use an appropriate supporting tool. The student knows testing levels, strategies and techniques, can create test cases and conduct unit testing with appropriate testing tools. The student knows the possibilities of test driven development, test automation and models for reviewing.

Contents:
Software quality and quality assurance. Software reviews and inspection. Fundamental concepts of software testing. Software testing techniques. Test-driven development. Test automation.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 32h, study group working 24h, paper reading 24h, exercises 24h, report writing 30 h

Target group:

Prerequisites and co-requisites:
Basic knowledge of software engineering, knowledge of Java programming language.
Recommended optional programme components:

Recommended or required reading:
To be announced during the course implementation but initially planned to be:
• Pezze M.,Young M., "Software Testing and Analysis: Process, Principles and Tech-niques", John Wiley&Sons, 2008
• A. P. Mathur, "Foundations of Software Testing", Prentice Hall, 2008
• Paul Ammann, Jeff Offutt, "Introduction to Software Testing", Cambridge University Press, 2008
• Kent Beck, "Test-Driven Development by Example", Addison-Wesley, 2002
• Lasse Koskela, "Test Driven: Practical TDD and Acceptance TDD for Java Devel-opers", Manning Publications, 2007
• Galin D., "Software Quality Assurance: From theory to implementation", Addison-Wesley, 2004
Assessment methods and criteria:
Report and exercise evaluation, active and regular attendance to lectures and exercises.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1–5
Person responsible:
 Burak Turhan
Working life cooperation:
No

812670S: The Next Generation of the Web, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Salman Mian

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
 English
Timing:
1 st – 2 nd year of Master's studies, spring semester, period 3
Learning outcomes:
After completing the course the student is able to:

   • Apply the lessons learned for web design, organisational purposes and entrepreneurial activities; and
   • Analyse issues related to web's development stages and trends and potentially even to predict potential future web;
   • Develop businesses based on technology road mapping, scenario thinking, future forecasting, and research methods and theories of technological innovation and diffusion.
Contents:

The course will help the student to recognise and reflect on on-going and potential future web development trends. It will build upon understanding of the contemporary web, its conceptual background, and the changes that lead to the web we see today. The ultimate goal for the course is to foresee the potential future of the web for the upcoming five years. Thus, the name of the course is The Next Generation of the Web.

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
 Lectures/seminars 24h, independent work (reading and essay writing) 110h.
Target group:

Prerequisites and co-requisites:
Course "813619S Emerging Technologies and Issues" (strongly recommended).
Recommended optional programme components:

Recommended or required reading:
Scientific articles, the web. More sources to be announced specifically during the course implementation.
Assessment methods and criteria:
Participation in the lectures, student paper (only in English).

Read more about assessment criteria at the University of Oulu webpage.
Grading:
 1–5
Person responsible:
Salman Mian
Working life cooperation:
No

812671S: Usability Testing, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Mikko Rajanen

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/135 hours of work

Language of instruction:
English and Finnish
Timing:
1 st – 2 nd year of Master's studies, spring semester, periods 3 and 4

Learning outcomes:
After completing the course, the student can:

- Design and follow through a usability testing process;
- Design usability test scenarios and tasks;
- Select test subjects;
- Plan and follow through usability tests as laboratory tests or field tests;
- Analyse and report the findings from usability tests.

Contents:
Basic terms and types of usability testing, usability tests process, usability test tasks and scenarios, test subjects, following through a usability test, analysing usability test material, reporting the findings from usability tests.

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 24h, assignment tutoring 13h, assignment 90h, seminar 7h.
Target group:
1 st and 2 nd year Master students
Prerequisites and co-requisites:
Student is familiar with most common user interface design terms, design and evaluation methods as in "Introduction to Human-Computer Interactions" course.
Recommended optional programme components:

Recommended or required reading:
Structure and contents of the course are based on:
- · Dumas, J. S. & Redish, J. C. (1993): A Practical Guide to Usability Testing. Ablex Publishing Corporation.
- · Rubin, J. (1994): Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests. Chichester: John Wiley & Sons, Inc.

Assessment methods and criteria:
Assessment of the course is based on the learning outcomes of the course based on the written usability test plan, supervised usability tests, written usability test report and oral seminar presentation

Grading:
 Pass/fail
Person responsible:
Mikko Rajanen
Working life cooperation:
No
Other information:

814601S: Work Experience in ICT responsibilities, 5 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Advanced Studies

Laji: Practical training

Arvostelu: 1 - 5, pass, fail

Opettajat: Tonja Molin-Juustila

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits/ (four months of full time work)

Language of instruction:
Guidelines, report template and documentation in English or in Finnish.
Timing:
Free
Learning outcomes:
Learning outcomes: After completing the course, a student:
- Masters certain part of professional ICT work in enterprises or public organisations;
- Can analyse and reflect on the work experience with Information Processing Science studies;
- Can write an informative report of his/her work experience.
Contents:
Working at least four months in professional ICT responsibilities that require university level studies. The work will be analysed and reflected by reporting.

Mode of delivery:
Working in professional ICT responsibilities at least four months to fulfil the learning outcomes, self-study.
Learning activities and teaching methods:
Professional ICT responsibilities at least four months to fulfil the learning outcomes.
Target group:

Recommended or required reading:
Studies and selected course materials are reflected on experience in professional ICT work.
Assessment methods and criteria:
Working in professional ICT responsibilities at least four months. Work experience can consist of more than one separate period with different employers. The work experience is proved by delivering a signed letter of reference and a report where it is reflected with the taken Information Processing Science studies. The studies are proved by delivering an up-to-date transcript of records. Proposals to develop Information Processing Science studies are included in the report.
Grading:
Pass/fail
Person responsible:
Tonja Molin-Juustila
Working life cooperation:
Working on professional ICT responsibilities.

Other information:
Report guidelines and a template are available by Optima. A copy of the letter of reference and working period will be recorded together with the credits.

817610S: Doing Software Business in China, 5 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Marianne Kinnula, Xiaosong Zheng

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
1 st – 2 nd year, spring semester, period 4

Learning outcomes:
After completion of the course, students will have a comprehensive understanding of software as a business and an industry in China. Students will recognise success factors, business models and development trends of the software business in China. Students will also understand the special characteristics of the software business in China.
Contents:
In the course a number of software business topics will be covered and these include: the current software market in China; software products and services in China; internationalisation and globalisation; revenue generation concepts; business planning in China; financing, pricing, cost and profitability; offer calculation; software engineering processes, and business project and entrepreneurship in China.

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 20h, assignment 60h, and exam 54. In the lectures much of the time will be devoted to discussing specific topics in small groups and among the class as a whole. In addition, case studies, home assignments and in-class presentation will be used. For the home assignment students are required to form a group (2 students per group) to complete a written report on a specific software business topic.
Recommended or required reading:
There is no prescribed textbook for this course. Instead, a reading brick comprising lecture notes, book chapters, journal articles and case studies relating to the various topics being covered will be made available for downloading.
Assessment methods and criteria:
1) Exam (50%), 2) home assignment and in-class presentation (50%).
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1-5
Person responsible:
Xiaosong Zheng ja Marianne Kinnula
Working life cooperation:
No

813626S: Emerging Technologies and Issues, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:

5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
1 st year of Master's and GS 3D studies, autumn semester, period 2
Learning outcomes:
 After completing the course, the student is able to **:**

- Analyse the on-going changes in online and consumer behaviour, customer requirements, ICT markets and technological development;
- Evaluate key enabling web technologies and become an effective participant in web-enabled business endeavours and initiatives;
- Design ways for leveraging information and communication technologies to improve intra- and inter-organisational processes and enhance a firm's competitive position;
- Plan ways for searching innovations; and
- Develop his/her skills for building careers and taking advantage of entrepreneurial opportunities through emerging technologies, in particular related to the web.

Contents:
1. A shift in thinking about the web and emerging technologies
2. How to social web is transforming businesses, software design, our perception of people as well as skills required of us
3. How to accelerate innovation creation through web-based and other emerging technologies: Ecosystem thinking, strategies, core business values
4. Transformation of the social web into humanized web

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 24h, reflective personal exercises 30h, independent work (required reading) 80h.

Target group:

Prerequisites and co-requisites:
None
Recommended optional programme components:

Recommended or required reading:
Oinas-Kukkonen Harri & Oinas-Kukkonen Henry (2013) Humanizing the Web: Change and Social Innovation. Palmgrave Macmillan, Basingstoke, UK (required reading).

Assessment methods and criteria:
Exam (only in English)

Grading:
1–5
Person responsible:
Harri Oinas-Kukkonen
Working life cooperation:
No

812351A: Enterprise Systems, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Li Zhao

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:

English
Timing:
1st year of Master's and GS3D studies, spring semester, period 3

Learning outcomes:
After completing the course, the student:

- Understands how ERP, SCM, KM, CRM, global supply chain, inventory management, and online business systems operate;
- Understands how business processes integrate the internal functions of the enterprise and allow the enterprise to interact with its business environment (such as suppliers, business partners, and customers);
- Is able to recognize, model, and improve business processes to help enterprises achieve efficiency, effectiveness, and competitive advantage;
- Understands how to do research on enterprise information systems.

Contents:
1. Principles of enterprise systems, and business processes that integrate the internal functions of the enterprise and connect the enterprise with its business environment;
2. Manage enterprises' intellectual capital to achieve competitive advantage;
3. Enterprise resource planning (ERP);
4. Supply chain management (SCM);
5. Global supply chain & inventory management systems
6. Knowledge management systems;
7. Customer relationship management (CRM);
8. Internet-based Business and Marketing Systems;
9. Enterprise application integration (EAI)

Learning activities and teaching methods:
The overall workload for each student in this course is 134 hours. Lectures (24h), exercises (16h), homework (25h), essay (35 h), examination (34h)
Target group:

Prerequisites and co-requisites:
Understanding of the business process modeling helps.

Recommended optional programme components:

Recommended or required reading:
Refer to the course webpages
Assessment methods and criteria:
Exercises, assignments, essay, and examination.

Grading:
1–5
Person responsible:
Li Zhao
Working life cooperation:
No

Compulsory

812351A-01: Enterprise Systems, exercise work, 0 op

Opiskelumuoto: Intermediate Studies

Laji: Partial credit

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Ei opintojaksokuvauksia.

812351A-02: Enterprise Systems, exam, 0 op

>**Opiskelumuoto:** Intermediate Studies
>**Laji:** Partial credit
>**Arvostelu:** 1 - 5, pass, fail
>**Opettajat:** Li Zhao
>**Opintokohteen kielet:** English

>Ei opintojaksokuvauksia.

812349A: IT Infrastructure, 5 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Katja Leiviskä
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
English
Timing:
1st year of Master's studies, spring semester, period 4

Learning outcomes:
After completing the course, students are able to judge, compare and apply data communications concepts to various situations encountered in industry; identify general concepts and techniques of data communications; explain the technology of the Internet; identify the most important server and storage architectures and the main mechanisms for providing high-capacity processing and storage capacity; and explain the regulatory environ-ment.
Contents:
1. Introduction to large-scale computing applications;
2. Network requirements and architecture;
3. Standards and standards bodies;
4. Network services and Middleware;
5. Internet services, protocols and technologies;
6. Underlying network technologies;
7. Performance monitoring, fault detection, recovery and restoration;
8. Next-generation network infrastructure, industry technology directions.
Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (24 h), student project work (90 h) and examination (20 h).
Target group:

Prerequisites and co-requisites:
Student is familiar with basic computer architecture and the Internet.
Recommended optional programme components:

Recommended or required reading:
- Lecture notes;
- Supplementary technical and scientific articles;
- Phil Simon (2010) The next wave of technologies: opportunities from chaos. Wiley. ISBN 0-47-058750-4.

Reference books:
- Comer, D.E. (2009) Computer Networks and Internets. 5th edition. Pearson ISBN 0-13-504583-5. 600 p.
- Kurose J.F., Ross K.W. (2010) Computer Networking – A Top-Down Approach. 5th edition. Pearson ISBN 0-13-

136548-7. 888 p.
• Travostino F., Mambretti J., Karmous-Edwards G. (2006) Grid Networks – Enabling grids with advanced communication technology. Wiley ISBN 0-470-01748-1. 340 p.

Assessment methods and criteria:
Individual project work, examination
Read more about assessment criteria at the University of Oulu webpage.
Grading:
 1–5
Person responsible:
 Anssi Öörni
Working life cooperation:
No

813623S: Information Security Policy and Management in Organisations, 5 op

Voimassaolo: 01.08.1950 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Seppo Pahnila, Petri Puhakainen

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
2nd year of Master's and GS3D studies, autumn semester, period 2 + 3

Learning outcomes:
After completing the course, the student is able to:

• Develop BPC;
• Develop organisation specific information security policies and sub-policy systems in organisations;
• Improve employees' compliance with the information security procedures through training, campaigning and other measures;
• Carry out risk management in practice;
• Estimate the economical investment in information security;
• Understand the strengths and weaknesses of information security management stan-dards;
• Understand the certifications in the area of information security management;
• Design information security policies at organisations.
Contents:
1.   BCP;
2.   Development of organisation specific information security policies and sub-policy systems at organisations;
3.   Measuring employees' compliance with information security policies;
4.   Improving employees' compliance with the information security procedures through training, campaigning and other means;
5.   Information security risk management in practice, estimation of economical investment in information security;
6.   Information security management standards;
7.   Certifications related to information security.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 30h, exercises 18h, student preparation and reading for exercises and examination 86h.
Target group:

Prerequisites and co-requisites:
Bachelor degree or other equivalent degree and course "811168P Introduction to Information Security" or principles of information security, or similar knowledge obtained from other courses.
Recommended optional programme components:

Recommended or required reading:
Articles (to be announced later)
Assessment methods and criteria:
Examination.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1–5
Person responsible:
Petri Puhakainen ja Seppo Pahnila
Working life cooperation:
No

814340A: Small-Group Tutoring, 3 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Leena Ventä-Olkkonen

Opintokohteen kielet: Finnish

ECTS Credits:
3 ECTS credits/80 hours of work

Language of instruction:
Finnish
Timing:
2 nd – 5 th year, autumn and spring semester, periods 1–4

Learning outcomes:
After passing the course a student (tutor) is able to:

- Draw up a supervision plan for his/her small group;
- Put into effect his/her supervision from the viewpoint of students and based on the given tutor training;
- Receive supervision and guidance experience;
- Take responsibility for his/her own supervision work.
Contents:
1. Group training, occasions and meetings 25h
2. Planning and implementation of small-group tutoring 53h
3. Writing his/her own report diary 2h.
Mode of delivery:
Face-to-face teaching and web-based teaching.
Learning activities and teaching methods:
Lectures, exercises and meetings. Practice as a small-group tutor in co-operation with other tutors, Blanko student organisation, library and own department's study-counsellors. Independent personal work.
Recommended or required reading:
Training materials, forms and own reports.
Assessment methods and criteria:
Active participation in tutor-training, implementing small-group tutoring and drawing up the supervision plan and the report diary.

Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail

Person responsible:
Leena Venntä-Olkkonen
Working life cooperation:
No

817603S: System Design Methods for Information Systems, 5 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Studies
Laji: Course
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

812670S: The Next Generation of the Web, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Salman Mian

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
 English
Timing:
1 st – 2 nd year of Master's studies, spring semester, period 3
Learning outcomes:
After completing the course the student is able to:

- Apply the lessons learned for web design, organisational purposes and entrepreneurial activities; and
- Analyse issues related to web's development stages and trends and potentially even to predict potential future web;
- Develop businesses based on technology road mapping, scenario thinking, future forecasting, and research methods and theories of technological innovation and diffusion.

Contents:

The course will help the student to recognise and reflect on on-going and potential future web development trends. It will build upon understanding of the contemporary web, its conceptual background, and the changes that lead to the web we see today. The ultimate goal for the course is to foresee the potential future of the web for the upcoming five years. Thus, the name of the course is The Next Generation of the Web.

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
 Lectures/seminars 24h, independent work (reading and essay writing) 110h.
Target group:

Prerequisites and co-requisites:
Course "813619S Emerging Technologies and Issues" (strongly recommended).
Recommended optional programme components:

Recommended or required reading:
Scientific articles, the web. More sources to be announced specifically during the course implementation.
Assessment methods and criteria:
Participation in the lectures, student paper (only in English).

Read more about assessment criteria at the University of Oulu webpage.
Grading:
 1–5
Person responsible:
Salman Mian
Working life cooperation:
No

812671S: Usability Testing, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Mikko Rajanen

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/135 hours of work

Language of instruction:
English and Finnish
Timing:
1 st – 2 nd year of Master's studies, spring semester, periods 3 and 4

Learning outcomes:
After completing the course, the student can:

- Design and follow through a usability testing process;
- Design usability test scenarios and tasks;
- Select test subjects;
- Plan and follow through usability tests as laboratory tests or field tests;
- Analyse and report the findings from usability tests.

Contents:
Basic terms and types of usability testing, usability tests process, usability test tasks and scenarios, test subjects, following through a usability test, analysing usability test material, reporting the findings from usability tests.

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 24h, assignment tutoring 13h, assignment 90h, seminar 7h.
Target group:
1 st and 2 nd year Master students
Prerequisites and co-requisites:
Student is familiar with most common user interface design terms, design and evaluation methods as in "Introduction to Human-Computer Interactions" course.
Recommended optional programme components:

Recommended or required reading:
Structure and contents of the course are based on:

- · Dumas, J. S. & Redish, J. C. (1993): A Practical Guide to Usability Testing. Ablex Publishing Corporation.
- · Rubin, J. (1994): Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests. Chichester: John Wiley & Sons, Inc.

Assessment methods and criteria:
Assessment of the course is based on the learning outcomes of the course based on the written usability test plan, supervised usability tests, written usability test report and oral seminar presentation

Grading:
 Pass/fail
Person responsible:
Mikko Rajanen
Working life cooperation:
No
Other information:

814601S: Work Experience in ICT responsibilities, 5 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Advanced Studies

Laji: Practical training

Arvostelu: 1 - 5, pass, fail

Opettajat: Tonja Molin-Juustila

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits/ (four months of full time work)

Language of instruction:
Guidelines, report template and documentation in English or in Finnish.
Timing:
Free
Learning outcomes:
Learning outcomes: After completing the course, a student:
- Masters certain part of professional ICT work in enterprises or public organisations;
- Can analyse and reflect on the work experience with Information Processing Science studies;
- Can write an informative report of his/her work experience.

Contents:
Working at least four months in professional ICT responsibilities that require university level studies. The work will be analysed and reflected by reporting.

Mode of delivery:
Working in professional ICT responsibilities at least four months to fulfil the learning outcomes, self-study.
Learning activities and teaching methods:
Professional ICT responsibilities at least four months to fulfil the learning outcomes.
Target group:

Recommended or required reading:
Studies and selected course materials are reflected on experience in professional ICT work.
Assessment methods and criteria:
Working in professional ICT responsibilities at least four months. Work experience can consist of more than one separate period with different employers. The work experience is proved by delivering a signed letter of reference and a report where it is reflected with the taken Information Processing Science studies. The studies are proved by delivering an up-to-date transcript of records. Proposals to develop Information Processing Science studies are included in the report.
Grading:
Pass/fail
Person responsible:
Tonja Molin-Juustila
Working life cooperation:
Working on professional ICT responsibilities.

Other information:
Report guidelines and a template are available by Optima. A copy of the letter of reference and working period will be recorded together with the credits.

902140Y: Cross-Cultural Competence and Communication Skills, 2 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Negotiated Education

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Proficiency level:
-
Status:
-
Required proficiency level:
-
ECTS Credits:
2 ECTS credits
Language of instruction:
English
Timing:
1st year of Master's studies, autumn semester
Learning outcomes:

By the end of the course students will be able to:
- demonstrate understanding and awareness of cultural differences and their effect on communication especially in the working life
- act and behave appropriately in different kind of situations by taking into consideration cultural differences
- demonstrate the ability to analyze one's own culture and discuss it with others

show an understanding of communication in Finnish working life and culture

Contents:
This course is designed to bring about an understanding of intercultural competence as well as awareness of one's own competence with cultural differences. In the course the background theory will be examined and one's own skills will be assessed. In the course negotiating skills across cultures will be studied using the 12 variables of negotiating. Cross-cultural differences in business correspondence will also be examined.

Mode of delivery:
Lectures, study groups, Optima

Learning activities and teaching methods:
Contact lessons (24 h) and homework. The course will also have a short study group segment to practice cross-cultural communicative activities.

Target group:
The students of International Master's Programme GS3D, Departement of Information Processing Science

Prerequisites and co-requisites:
-

Recommended optional programme components:
-

Recommended or required reading:
Will be provided by the teacher.

Assessment methods and criteria:
Participation in the class room sessions, homework and study group assignments.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
pass/fail

Person responsible:
Anne Koskela and Jaana Sorvari

Working life cooperation:
-

Other information:
Sign-up in WebOodi.

817604S: ICT and Organizational Change, 5 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Minna Isomursu

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
2nd year, autumn semester, periods 1+2
Learning outcomes:
After completing the course the student is:

- Able to distinguish various levels of organisational activities and their relations;
- Able to discuss about the role of information technology in various levels of change of organisation and its context;
- Able to analyse ICT-based organizational change process.

Contents:
The course studies organisations at four levels: individuals, practices, organizational structures and transformations, and the societal context of organisations. The organizational role of ICT and the relation between ICT and knowledge are also discussed. A method for analysing organisations as networks of activity systems is presented. The role of

power, trust and control in the change process is discussed. The different aspects of change agents are presented and analysed.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Introductory lectures 20h, seminar sessions 14h, individual work 100h (for a review and analysis of selected course materials and making a presentation for the seminar).

Prerequisites and co-requisites:
B.Sc. or other equivalent degree and course Information Systems in Organisations (812304A) or equivalent knowledge.

Recommended optional programme components:

Recommended or required reading:
A list of research articles will be provided for the lectures and assignments. Readings for the background and theoretical framework are:
•   Gareth R. Jones (2010) Organizational Theory, Design, and Change: Global Edition (6. Ed.) Chapters 1-3, 10-12, Prentice Hall.
•   K. Kuutti (1996) Activity Theory as a potential framework for human-computer inter-action research, in Context and Consciousness: Activity Theory and Human Com-puter Interaction, B. Nardi, Editor. 1996, MIT Press: Cambridge. p. 17-44.
•   Frank Blackler (1995) Knowledge, knowledge work and organizations: an overview and interpretation. Organization studies, 1995. Pp. 1021-1046
•   Frank Blackler et al. (2000) Organizing Processes in Complex Activity Networks. Organization, vol. 7 no. 2. Pp. 277-300.

Assessment methods and criteria:
Lecture and seminar participation, assignment (literature review, analysis, seminar presentation). Alternatively by examination and personal assignment report.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
1-5

Person responsible:
Minna Isomursu

Working life cooperation:
No

812349A: IT Infrastructure, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Katja Leiviskä

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
English

Timing:
1st year of Master's studies, spring semester, period 4

Learning outcomes:
After completing the course, students are able to judge, compare and apply data communications concepts to various situations encountered in industry; identify general concepts and techniques of data communications; explain the technology of the Internet; identify the most important server and storage architectures and the main mechanisms for providing high-capacity processing and storage capacity; and explain the regulatory environ-ment.

Contents:
1. Introduction to large-scale computing applications;
2. Network requirements and architecture;

3. Standards and standards bodies;
4. Network services and Middleware;
5. Internet services, protocols and technologies;
6. Underlying network technologies;
7. Performance monitoring, fault detection, recovery and restoration;
8. Next-generation network infrastructure, industry technology directions.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (24 h), student project work (90 h) and examination (20 h).
Target group:

Prerequisites and co-requisites:
Student is familiar with basic computer architecture and the Internet.
Recommended optional programme components:

Recommended or required reading:
• Lecture notes;
• Supplementary technical and scientific articles;
• Phil Simon (2010) The next wave of technologies: opportunities from chaos. Wiley. ISBN 0-47-058750-4.

Reference books:
• Comer, D.E. (2009) Computer Networks and Internets. 5th edition. Pearson ISBN 0-13-504583-5. 600 p.
• Kurose J.F., Ross K.W. (2010) Computer Networking – A Top-Down Approach. 5th edition. Pearson ISBN 0-13-136548-7. 888 p.
• Travostino F., Mambretti J., Karmous-Edwards G. (2006) Grid Networks – Enabling grids with advanced communication technology. Wiley ISBN 0-470-01748-1. 340 p.

Assessment methods and criteria:
Individual project work, examination
Read more about assessment criteria at the University of Oulu webpage.
Grading:
 1–5
Person responsible:
 Anssi Öörni
Working life cooperation:
No

813623S: Information Security Policy and Management in Organisations, 5 op

Voimassaolo: 01.08.1950 -
Opiskelumuoto: Advanced Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Seppo Pahnila, Petri Puhakainen
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
2nd year of Master's and GS3D studies, autumn semester, period 2 + 3

Learning outcomes:
After completing the course, the student is able to:

• Develop BPC;
• Develop organisation specific information security policies and sub-policy systems in organisations;
• Improve employees' compliance with the information security procedures through training, campaigning and other

measures;
- Carry out risk management in practice;
- Estimate the economical investment in information security;
- Understand the strengths and weaknesses of information security management stan-dards;
- Understand the certifications in the area of information security management;
- Design information security policies at organisations.

Contents:
1. BCP;
2. Development of organisation specific information security policies and sub-policy systems at organisations;
3. Measuring employees' compliance with information security policies;
4. Improving employees' compliance with the information security procedures through training, campaigning and other means;
5. Information security risk management in practice, estimation of economical investment in information security;
6. Information security management standards;
7. Certifications related to information security.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 30h, exercises 18h, student preparation and reading for exercises and examination 86h.

Target group:

Prerequisites and co-requisites:
Bachelor degree or other equivalent degree and course "811168P Introduction to Information Security" or principles of information security, or similar knowledge obtained from other courses.

Recommended optional programme components:

Recommended or required reading:
Articles (to be announced later)

Assessment methods and criteria:
Examination.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
1–5

Person responsible:
Petri Puhakainen ja Seppo Pahnila

Working life cooperation:
No

813625S: Information Systems Theory, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 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 (40.5 hours of work), class preparation 1.5 ECTS (40.5 hours of work), and exercises 2 ECTS (53 hours of work).

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, class quizzes, and research essay are assessed. Note that there is no final exam.
Grading:
1–5
Person responsible:
Netta Iivari
Working life cooperation:
No
Other information:
Course material can be found at OPTIMA e-learning environment, Urkund is used for course work submissions.

813613S: Master's Thesis, 30 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Diploma thesis

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:
30 ECTS credits/800 hours of work.

Language of instruction:
Finnish/English.

Timing:
Timing is free; execution can be allocated over several semesters. Obligatory for Master's degree. During 1st and 2nd year of Master's studies.
Learning outcomes:
After completing the thesis the student can:

- Define a relevant focused problem in the field of information processing science;
- Apply a scientific method as a tool in solving the stated research problem;
- Synthesise research results and evaluate their validity;
- Write a scientific thesis based on the accomplished research according to the de-partment's guidelines;
- Participate in the evolution of ICT and postgraduate studies after completing the thesis.

Mode of delivery:
Face-to-face meetings and electronic communication with the supervisor.

Learning activities and teaching methods:
Conducting and reporting research under supervision of personal advisor.

Prerequisites and co-requisites:
The research plan and the final draft of the thesis will be presented in the "Master's Thesis Seminar" (813602S).

Assessment methods and criteria:
Read more about assessment criteria at the University of Oulu webpage.

Grading:
The supervisor and a second independent reviewer will evaluate the thesis using the scale 1–5.

Person responsible:
Kari Kuutti

Working life cooperation:
Especially empirical Master's theses are often done in cooperation with private or public sector.

813627S: Master's Thesis Seminar, 2 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Required proficiency level:

ECTS Credits:
1-2 ECTS credits/26-52 hours of work

Language of instruction:
Finnish / English

Timing:
1 st – 2 nd year of Master's studies, autumn and spring semesters, periods 1-4.

Learning outcomes:
By completing this course the students can plan a scientific study, is capable of presenting own research plan and final draft of own Master's thesis, and understands the approach the reviewers use to evaluate the thesis.

Contents:
See "assessment methods" below.

Mode of delivery:
Mainly face-to-face seminar meetings, if needed telecom meetings are possible.

Learning activities and teaching methods:
Planning and presenting the student's own research. Listening to peers' research plans and research reports.

Target group:

Prerequisites and co-requisites:
"813613S Master's Thesis" course.

Recommended optional programme components:

Recommended or required reading:
 Guidelines to producing a Master's thesis.
Assessment methods and criteria:
Active participation in four (1ECTS) or seven (2ECTS) seminar sessions. One session lasts about 2 hours and they are arranged during the semesters according to the plan published on the website. The students will present their own research plan and the research before official evaluation. During the presentation the research will be discussed critically by an opponent.
Grading:
Pass/fail

Person responsible:
Autumn 2015 Seppo Pahnila
Spring 2016 Raija Halonen and Markku Oivo
Working life cooperation:
No
Other information:

815657S: Open Source Software Development, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Henrik Hedberg

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits / 133 hours of work
Timing:
1 st year of Master's studies, periods 1+2
Learning outcomes:
After passing the course, a student will be able to

- define the historical background and the ideology of Open Source Software (OSS),

- participate in OSS development project,

- evaluate the impact of the usage of OSS and OSS licenses on software development and exploitation, and

- view the phenomenon through the essential scientific research.

Contents:
The course introduces OSS development paradigm and current topics in OSS research. OSS affects both the way to produce software and the decisions of user organizations. It can be understood, for example, from different social, legal, economical, software engineering and data security viewpoints. The aim is to study from different perspectives, 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 on research work.

Mode of delivery:
Mostly face-to-face teaching but some parts are implemented as distance learning
Learning activities and teaching methods:
 Lectures and seminars about 40 h, exercises and peer reviews about 20 h, seminar article and presentation about 70 h
Prerequisites and co-requisites:
Compulsory prerequisites are Bachelor degree or other equivalent degree and basic knowledge on software engineering and research work. The course allows passing Project following the OSS development principles, or writing Master's thesis on a OSS topic.
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; scientific articles covering the topic.
Assessment methods and criteria:
Active participation, seminar article and other assignments
Grading:
1-5
Person responsible:
Henrik Hedberg

811392A: Preparatory Course for MSc Studies, 5 op

Voimassaolo: 01.03.2014 - 31.12.2018

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Arto Lanamäki

Opintokohteen kielet: English

ECTS Credits:
2 ECTS credits / 54 hours of work
Language of instruction:
English.
Timing:
1 st year of Master's studies, period 1.
Learning outcomes:
 After completing the course, the student is able to participate in courses requiring basic knowledge of project work. The student is able to apply the basic concepts of project work, act in different roles in projects and is able to describe the significance of the different project outcomes, such as project plan, mid-reports and final reports. The student is able to define the principles of project coordination and communication with the project interest groups. Additionally, the student is able to consider the principles of referenced and scientific writing.
Contents:
The focus of the course is in the people, process and tools of a project in information technology field. Course covers the basic principles of project management, planning, coordination and communication within the project as well as outside the project. Course presents the different outcomes of the project, related to internal and external communication – project plans, mid-report, final reports and other project specific outcomes, as well as internal reports, memos and non-written communication and coordination techniques in a project. The latter include unofficial and official meetings held within the project as well as among the external interest groups of the project (for example, customers and the project steering group). Finally, the course presents the basics of written referenced and scientific communication – how to use references, how to acknowledge work of others, how to format an article and what is plagiarization and how to avoid plagiarization.

Mode of delivery:
Blended teaching.
Learning activities and teaching methods:
Lectures and exercises 20h, independent learning methods 34h.
Target group:
Master's students of the department, compulsory for the GS3D students. Note that it is not possible to take both this and these related courses: 811311A Project management principles and 811382A Introduction to research work.

Prerequisites and co-requisites:
BSc degree in Information Technology or equivalent field.
Recommended optional programme components:
Especially recommended to take before these courses: Project II, Software factory project course.
Recommended or required reading:
Provided when the course starts
Assessment methods and criteria:
Active participation in the lectures and exercises.
Grading:
Passed/failed
Person responsible:

Arto Lanamäki
Working life cooperation:
No

813621S: Research Methods, 5 op

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Arto Lanamäki

Opintokohteen kielet: English

Leikkaavuudet:

521146S   Research Methods in Computer Science   5.0 op

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
English
Timing:
The course starts in autumn and continues to spring semester (periods 2 and 3). It is recommended that the course is completed during the first year of Master's studies.

Learning outcomes:
Having completed the course, the student is able to explain the general principles of scientific research and the practices of scientific methodology. The student is also able to generate research problems in information systems and software engineering. The student is able to identify and describe the main research approaches and methods in information systems and software engineering and choose the appropriate approach and method for a research problem. The student is also able to evaluate the methodological quality of a research publication. After the course the student is able to choose and apply the proper approach and method for his or her Master's thesis and find more information on the method from scientific literature.
Contents:
Introduction to general scientific principles, scientific research practices and quality of scientific publications, qualitative research approaches and selected research methods, quantitative research approaches and selected research methods, design science research and selected methods, requirements and examples of Master's theses, evaluation of research.

Mode of delivery:
Face-to-face teaching and independent studying.

Learning activities and teaching methods:
Lectures 40h, exercises 30h and individual work 65h. Learning diary is written about the lectures and exercises. Exercises include group work.

Target group:

Prerequisites and co-requisites:
Completion of Bachelor's studies

Recommended optional programme components:

Recommended or required reading:
Lecture slides and specified literature

Assessment methods and criteria:
Accepted learning diary

Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass/fail

Person responsible:
Arto Lanamäki
Working life cooperation:
No
Other information:
-

813630S: Software Business Development, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Jukka Kontula

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
 English
Timing:
The course unit is held in the autumn semester, during period 2. It is recommended to complete the course in the first or second year of Master's studies.

Learning outcomes:
The course provides insights to business development on a business, company and industry level. After completing the course, the student is able to plan how business is being developed over the whole life cycle of the business and company, conduct market and business analyses, identify different sources of financing for business operation, evaluate different strategic business options and select a business model adequate for the present and future situation of the company.
Contents:
The course takes three points of view: company start-up, established business, and software industry. The course introduces the concepts of business idea, business plan, software business models and strategies, and the software value network.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 24h, exercises 12h, course assignments 78h, exam 20h. The course assignments will be conducted as group work.

Target group:

Prerequisites and co-requisites:
The recommended prerequisite is the completion of the following courses prior to enrolling for the course unit: 811174P Introduction to Software Business, 813316A Business Process Modelling and 813620S Software Business and IT Management.
Recommended or required reading:
Refer to the course web pages

Assessment methods and criteria:
This course unit utilizes continuous assessment. Lectures are for the most part voluntarily, but participation is recommended. The students will write course assignments which will be assessed. In addition, there will be an exam at the end of the course which will be assessed. 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:
 1–5

Person responsible:
Jukka Kontula
Working life cooperation:
No

813620S: Software Business Management, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Marianne Kinnula

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
 English

Timing:
1 st–2 nd year of Master's studies, autumn semester, period 3

Learning outcomes:

Upon completion of the course, the student
- will be able to assess the main problem areas in software business management and is able to describe how to manage these problems;
- will be able to find, when needed, different kinds of tools for managing this diverse and ambiguous environment;
- will be able to describe how to manage competent and creative persons who often have strong personalities;
- will be able to analyse a company situation in a continually changing, unpredictable and even hostile environment, and is able to make well-grounded recommendations for the company courses of action;

Contents:
The software business environment and context is complex and under continuous change. Competences and creativity of company employees are needed for creating value and growth to the company. Managing a software business is a challenging task as traditional, rational management models are often inadequate for the needs of the managers. This course provides an overview of the management of the software business in a software company. Aspects of management of SME companies are discussed as well as significance of IT management in an organisation.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures and exercises 35h, group work 30h, course assignments and independent work 69h.

Prerequisites and co-requisites:
Basic knowledge of academic writing technique is needed. Basic understanding of the software business is an advantage.

Recommended optional programme components:

Recommended or required reading:
Course material and related literature.

Assessment methods and criteria:
Participation in lectures/exercises, group work, course assignments.

Grading:
1-5

Person responsible:
Marianne Kinnula

Working life cooperation:
No

817602S: Software Development in Global Environment, 5 op

Voimassaolo: 01.08.2011 -
Opiskelumuoto: Advanced Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Similä, Jouni Kalervo
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/135 hours of work.

Language of instruction:
English
Timing:

1 st year of Master's studies, fall semester.
Learning outcomes:
After completing the course, the student

- Can define the key success factors of Global Software Design (GSD) and the potential problems in coordination of projects where teams are separated by physical and/or temporal distance;
- Can define and evaluate the collaborative technologies, which in the best way support distributed software development;
- Can choose the methods and tools for distributed software development;
- Can apply the practices of GSD in a student project and use the supporting tools throughout the project life cycle.

Contents:
Some of the topics covered are strategic issues in distributed development (off-shoring, near-shoring, outsourcing, OSS); cost-benefit-risk analysis; the triad of coordination, control and communication; team building (e.g. virtual teams); software process paradigms in the global environment (planned, agile); methods and tools for distributed software development; issues related to allocation of tasks; communication issues that arise due to distance and time zone differences; infrastructure support; geographical dispersion; lack of information communication; coordination complexity; cultural issues; technical issues related to information and artefact sharing; architectural design; and finally knowledge management issues. The lectures and seminars also review current research aspects of the GSD and related case studies from industry. The exercises demonstrate distributed software development as a virtual team with the support of appropriate methods and tools.

Mode of delivery:
Face-to-face lectures and seminars with all the students. Lecture assignments: reading articles and writing analyses. Communication between exercise groups of 4 students is done over the internet.

Learning activities and teaching methods:
Lectures and seminars involving all the students as well as lecture assignments (reading articles and writing analyses) 70h (20h lecture attendances, 30h lecture assignments, 20h additional reading), and exercises 65h. For lecture assignments each student will read, summarize and analyse selected academic articles. The exercises include laboratory demonstrations of different supporting tools for distributed software development. The students train in project software development and planning practices in a distributed environment. The student project groups are organised into virtual (distributed) teams of 4 students.
Target group:
Obligatory course for students majoring in Software Engineering and GS3D.

Recommended or required reading:
To be announced during the course implementation.
Assessment methods and criteria:
By active participation or alternatively exam, based on the course study materials.

Grading:
1–5, active participation: lectures (25%), lecture assignments (25%), exercises (50%).

Person responsible:
Jouni Similä
Working life cooperation:
No
Other information:
 Participation: The course is obligatory for GS ³D students and software engineering students; the total number of students is limited according to the departmental selection rule (valintasääntö, kts. Opinto-opas). 80% attendance is required. Web page **:**
https://noppa.oulu.fi/noppa/kurssi/817602s/etusivu

815662S: Software Engineering Management, Measurement and Improvement, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Oivo, Markku Tapani

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Timing:
2 nd year of Master's and GS ³D studies, autumn semester, period 2
Learning outcomes:
After completing the course the student understands the fundamental principles of software processes and their development in professional software engineering. The course extends the quality understanding based on individual techniques (e.g. reviews) so that after completing the course the student is able to:

- Evaluate different methods and techniques;
- Select from them appropriate ones for different software engineering environments;
- Have capabilities to participate in systematic efforts for improvement in software companies.

Contents:
The course covers the most fundamental process centred software quality improvement and management approaches, methods and latest research results, as well as approaches to software measurement. The topics of the course include: traditional waterfall, agile (extreme programming, scrum, rational unified process, crystal, feature driven development, adaptive software development, dynamic systems development method) and lean methods, process improvement approaches, software process and product measurement, agile and lean practices, process improvement at the enterprise level and practical examples from software industry.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 18h, study group working 25h, paper reading 25h, seminar 20h, report writing 20h
Prerequisites and co-requisites:
 B.Sc. or other equivalent degree and basic knowledge of software engineering
Recommended or required reading:
- CMMI: Guidelines for Process Integration and Product Improvement. Mary Beth Chrissis, Mike Konrad, Sandy Shrum. Addison-Wesley, ISBN 032-115496-7, 2004.
- Agile Project Management with Scrum. Ken Schwaber, Microsoft Press, ISBN 0-7356-1993-X. 2004.
- Dingsøyr T., Dybå T., Moe N.B., Agile Software Development: Current Research and Future Directions, Springer, 2010
- C. Jones, Applied Software Measurement: Global Analysis of Productivity and Quality, 3rd ed. McGraw-Hill Osborne Media, 2008.
- Craig Larman and Bas Vodde, Scaling Lean & Agile Development: Thinking and Organizational Tools for Large-Scale Scrum, Addison-Wesley, 2009

Assessment methods and criteria:
Active and regular participation to lectures and seminars AND report evaluation AND seminar presentations
Grading:

1-5
Person responsible:
Markku Oivo

815663S: Software Engineering Research, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Burak Turhan

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/132 hours of work
Timing:
2 nd year of Master's studies, autumn semester, period 1+2

Learning outcomes:
After completing the course the student will know the current research areas in software engineering and the most important software engineering research methods. The student understands academic research and publishing in software engineering, and is able to critically analyse scientific articles from the viewpoint of the content and research methods used in the article. The student is able to present academic research and actively participate in an academic discussion of research papers and research results.
Contents:
Empirical research methods for software engineering: experiments, case studies, surveys, systematic literature reviews and replications in software engineering. Research topics in empirical software engineering.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures and seminars 33h, assignments and paper reading 33h, weekly study 66h.
Prerequisites and co-requisites:
B.Sc. or other equivalent degree
Recommended or required reading:
   • Wohlin C., Runeson P., Höst M., Ohlsson M., Regnell B., Wesslen A., Experimentation in Software Engineering, Springer, 2012,.
   • Per Runeson, Martin Host, Austen Rainer, Bjorn Regnell: Case Study Research in Software Engineering: Guidelines and Examples, Wiley, 2012.

Assessment methods and criteria:
Active and regular attendance (mandatory) to lectures and seminars.
Grading:
The course unit utilizes a numerical grading scale 1-5. In the numerical scale zero stands for a fail

Person responsible:
Burak Turhan
Other information:
It is not possible to complete the course remotely or with self-study options.

817614S: Software Factory Project, 10 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Kari Liukkunen

Opintokohteen kielet: English

ECTS Credits:

10 ECTS credits / 260 hours of work
Language of instruction:
English
Timing:
The course is held two times a year: in the autumn semester periods 1 & 2; and in the spring semester periods 3 & 4
Learning outcomes:
After completing the course students should demonstrate their abilities to work on a challenging global ICT project. Students will apply new knowledge in the topic of the project, as well as to analyze and report the created new knowledge to peer student groups. Students will also demonstrate their skills to conduct global ICT project. Additionally, the students will use up to date software engineering methods, techniques and tools in global distributed environment. The topics for the course are focused on distributed software development using Lean approach.

After successfully completing the software factory project, students are able to:
- Collectively produce, monitor and update the plan of the project (project with fixed time and human resources);
- Demonstrate issues within the software development life cycle and critically evaluate personal performance especially in distributed context;
- Apply advanced software engineering methods, tools and techniques and technical knowledge of the specific project domain within that context to satisfy specific project requirements;
- Generate technical documents according to relevant standards, and apply appropriate tracking and control procedures;
- Demonstrate project practices when conducting meetings and code reviews. Manage and report the progress of the project with the steering group/project team organization;
- Develop analytical and creative skills for successful completion of the project;
- Monitor and communicate the status (time & human resources used) of the project in real time within the project team;
- Use systematic means (e.g. ICT tools) to enable communication and transparency of the project work;
- Cooperate with client and provide technical presentations at various phases of the project;
- Manage a successful project review with the steering group/project team organization; report and explain the status (progress, results and future estimations of the project) to the steering group to support the decision making and problem resolution concerning the project's future;
- Work as responsible project team member; as an expert and/or project manager;
- Work as a project team member with people from different technical and/or cultural backgrounds;
- Produce a realistic outcome in relation to the project time and human resources (ok, good, excellent);
- Reflect the relationship between the process model(s) selected for the project (waterfall, evolutionary, agile etc.) and the management practices followed in the project;

Contents:
Starting lectures, where the steps of carrying out the course will be described together with allocating the project assignments to project teams. Also, Software Factory working methods are presented. During the course students attend intense software development project and present their results.
Mode of delivery:
Face-to-face teaching at the beginning of the course together with web-based learning environment. During the project work student work in both collocated and distributed teams. Each of the project group will be supported with a supervisor.
Learning activities and teaching methods:
The course work load is 260h per student (9h lectures and 251h project work). Working hours will be reported during the project. Attendance at the starting lectures and working in software factory is mandatory. Training will be given to students on the required methods, tools, and techniques at the beginning of the project work. Depending on the project the student work on regular basis in the software factory premises.
Target group:
GS3D master's level students
Prerequisites and co-requisites:
Mandatory B.Sc. degree or other equivalent and the course Software Development in Global Environments 817602S. Preparatory course for MSc studies 811392A is recommended.

Recommended or required reading:
Project material will be provided by the customer of the project and/or material to be collected and studied by the project team.
Assessment methods and criteria:
Real application and/or prototype of software along with professional project management skills will be reported in a project portfolio. Assessment criteria will be given at the starting lecture in detail.
Grading:
1-5
Person responsible:
Kari Liukkunen

Working life cooperation:
Yes, learning project work and integrating the practices of an academic expert into the unique project assignment.
Other information:
Enrollment for the course is well beforehand.

817603S: System Design Methods for Information Systems, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

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

812650S: Advanced Topics in Human-Centred Design, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Mikko Rajanen, Netta Iivari

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/135 hours of work
Language of instruction:
  English
Timing:
1 st – 2 nd year of Master's studies, spring semester, period 3

Learning outcomes:
After completing the course, students are familiar with some state-of-the-art research results related to current themes and contexts in human-centred design, they understand the strengths and limitations of various methods and frameworks used in human-centred design and they can acquire knowledge and critically read relevant research articles on human-centred design research topics.
Contents:
The content of the course will change with time. The initial set of topics includes:
- Current themes
  - User experience as an object of analysis and design
  - Participatory design, end-user-design and living labs
  - Information ecologies and infrastructures
  - Design for all
  - Iterative and incremental design and development
  - The impact of human-centred design
  - Current development contexts:
    - Open source software development
    - Game development
    - Development of ICT for children
    - Ubiquitous computing

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 20h, assignments 100h, seminars 15h

Target group:

Prerequisites and co-requisites:
Course "812335A Interaction Design" or similar knowledge.

Recommended optional programme components:

Recommended or required reading:
A collection of research papers supported with lecture materials. Students also need to collect some study material by themselves.
Assessment methods and criteria:
Depending on the implementation group and/or individual assignments, evaluated according to predefined evaluation criteria.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
  1–5

Person responsible:
 Kari Kuutti
Working life cooperation:
No

817610S: Doing Software Business in China, 5 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Marianne Kinnula, Xiaosong Zheng

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
1 st – 2 nd year, spring semester, period 4

Learning outcomes:
After completion of the course, students will have a comprehensive understanding of software as a business and an industry in China. Students will recognise success factors, business models and development trends of the software business in China. Students will also understand the special characteristics of the software business in China.
Contents:
In the course a number of software business topics will be covered and these include: the current software market in China; software products and services in China; internationalisation and globalisation; revenue generation concepts; business planning in China; financing, pricing, cost and profitability; offer calculation; software engineering processes, and business project and entrepreneurship in China.

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 20h, assignment 60h, and exam 54. In the lectures much of the time will be devoted to discussing specific topics in small groups and among the class as a whole. In addition, case studies, home assignments and in-class presentation will be used. For the home assignment students are required to form a group (2 students per group) to complete a written report on a specific software business topic.
Recommended or required reading:
There is no prescribed textbook for this course. Instead, a reading brick comprising lecture notes, book chapters, journal articles and case studies relating to the various topics being covered will be made available for downloading.
Assessment methods and criteria:
1) Exam (50%), 2) home assignment and in-class presentation (50%).
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1-5
Person responsible:
Xiaosong Zheng ja Marianne Kinnula
Working life cooperation:
No

813626S: Emerging Technologies and Issues, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
1 st year of Master's and GS 3D studies, autumn semester, period 2
Learning outcomes:
 After completing the course, the student is able to **:**

- Analyse the on-going changes in online and consumer behaviour, customer requirements, ICT markets and technological development;
- Evaluate key enabling web technologies and become an effective participant in web-enabled business endeavours and initiatives;
- Design ways for leveraging information and communication technologies to improve intra- and inter-organisational processes and enhance a firm's competitive position;
- Plan ways for searching innovations; and
- Develop his/her skills for building careers and taking advantage of entrepreneurial opportunities through emerging technologies, in particular related to the web.

Contents:
1. A shift in thinking about the web and emerging technologies
2. How to social web is transforming businesses, software design, our perception of people as well as skills required of us
3. How to accelerate innovation creation through web-based and other emerging technologies: Ecosystem thinking, strategies, core business values
4. Transformation of the social web into humanized web

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 24h, reflective personal exercises 30h, independent work (required reading) 80h.

Target group:

Prerequisites and co-requisites:
None
Recommended optional programme components:

Recommended or required reading:
Oinas-Kukkonen Harri & Oinas-Kukkonen Henry (2013) Humanizing the Web: Change and Social Innovation. Palmgrave Macmillan, Basingstoke, UK (required reading).

Assessment methods and criteria:
Exam (only in English)

Grading:
1–5
Person responsible:
Harri Oinas-Kukkonen
Working life cooperation:
No

812351A: Enterprise Systems, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Li Zhao

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
English
Timing:
1st year of Master's and GS3D studies, spring semester, period 3

Learning outcomes:
After completing the course, the student:

- Understands how ERP, SCM, KM, CRM, global supply chain, inventory management, and online business systems operate;
- Understands how business processes integrate the internal functions of the enterprise and allow the enterprise to interact with its business environment (such as suppliers, business partners, and customers);
- Is able to recognize, model, and improve business processes to help enterprises achieve efficiency, effectiveness, and competitive advantage;
- Understands how to do research on enterprise information systems.

Contents:
1. Principles of enterprise systems, and business processes that integrate the internal functions of the enterprise and connect the enterprise with its business environment;
2. Manage enterprises' intellectual capital to achieve competitive advantage;
3. Enterprise resource planning (ERP);
4. Supply chain management (SCM);
5. Global supply chain & inventory management systems
6. Knowledge management systems;
7. Customer relationship management (CRM);
8. Internet-based Business and Marketing Systems;
9. Enterprise application integration (EAI)

Learning activities and teaching methods:
The overall workload for each student in this course is 134 hours. Lectures (24h), exercises (16h), homework (25h), essay (35 h), examination (34h)
Target group:

Prerequisites and co-requisites:
Understanding of the business process modeling helps.

Recommended optional programme components:

Recommended or required reading:
Refer to the course webpages
Assessment methods and criteria:
Exercises, assignments, essay, and examination.

Grading:
1–5
Person responsible:
Li Zhao
Working life cooperation:
No

Compulsory

812351A-01: Enterprise Systems, exercise work, 0 op

Opiskelumuoto: Intermediate Studies
Laji: Partial credit
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: English

Ei opintojaksokuvauksia.

812351A-02: Enterprise Systems, exam, 0 op

> **Opiskelumuoto:** Intermediate Studies
>
> **Laji:** Partial credit
>
> **Arvostelu:** 1 - 5, pass, fail
>
> **Opettajat:** Li Zhao
>
> **Opintokohteen kielet:** English

> Ei opintojaksokuvauksia.

812331A: Interaction Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Netta Iivari

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/133 hours of work
Language of instruction:
English
Timing:
1st year of Master's studies, autumn semester period 1
Learning outcomes:
Objective: The course explains the role of human interaction with IT products, systems, and services, explains the factors and problems related to it to motivate interaction design, and teaches some user-centered methods for analysis, evaluation and design of interactions.
Learning Outcomes: After completing the course, the student can assess the role of human interaction with IT products, systems, and 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 and user experience for user interface design;
- use interaction design methods in designing for target user experiences.

Contents:
The course provides an overview of interaction design, introducing the terminology and fundamental concepts, the main activities, and the importance of user involvement in the design process. The course addresses establishing requirements for IT products, systems, and services. The focus is on usability and user experience from the viewpoint of the intended users, their tasks and the context of use. The course covers user-centered methods for designing for and evaluating usability and user experience of IT products, systems, and services. All the main activities of interaction design are carried out in a practical design case.
Mode of delivery:
Face-to-face teaching, self-study
Learning activities and teaching methods:
Lectures (20 h), exercises and seminar (25 h), individual and group assignments (88 h), or self-study: an opening lecture (2 h), one larger assignment (110 h) and individual tasks (21 h).
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:
Rogers, Sharp and Preece (2011, 3rd edition) *Interaction Design: Beyond Human-Computer Interaction* and related lecture and assignment materials
Assessment methods and criteria:
Accepted assignments and individual tasks

Grading:

1-5
Person responsible:
Netta Iivari
Working life cooperation:
No

817609S: Project Seminar, 3 op

Voimassaolo: 01.08.2013 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Tonja Molin-Juustila

Opintokohteen kielet: English

ECTS Credits:
3 ECTS credits / 70 hours of work
Language of instruction:
English.
Timing:
The timing of this course is dependent on the "Research and Development Project (817612S)" course and will immediately follow the project in the next semester: 2 nd year, period 3.
Learning outcomes:
After completing the course, the students should demonstrate their abilities to work as academic experts in challenging ICT projects. Students will learn to acquire and apply research articles and other new knowledge like an academic expert in a selected topic of their project ("Research and Development Project (817612S)" course). Students will also learn to analyse and report their experience-based new knowledge on the topic to peer students. By completing this course, students are able to act as reflective, independent academic experts in ICT projects and have learnt expertise in some topic area of their project.
As an expert in the selected topic area, the student is able to
-       Search research articles and literature on the topic (review);
-       Report practical experiences gained during the project on the topic;
-       Evaluate the results of the project and reflect the practical experiences against previous literature and research on the topic;
-       Disseminate the (increased) expertise in the topic in a credible way to peers both by a written report and orally.
Contents:
Starting lecture, independent analysis and reporting of the expertise on the selected project topic and an expert seminar (1-2 days) with the presentations of each topic.
Mode of delivery:
Face-to-face teaching during the starting lecture and the seminar, private supervisor for each topic, and web-based learning environment.
Learning activities and teaching methods:
70h per student. Attendance at the starting lecture and the expert seminar is mandatory.
Target group:
Master's level students. Optional for the students of the Master's degree programme on Software, Systems, and Service Development (GS3D).
Prerequisites and co-requisites:
Mandatory: Research and Development Project (817612S) during the previous two periods. This course will immediately follow the project course on the project topics. For the students of the Master's degree programme on Software, Systems, and Service Development (GS3D), Software Factory Project Course (817611S) is mandatory before this course.

Recommended or required reading:
Research articles and material to be collected and studied by the students.
Assessment methods and criteria:
Expertise in the topic area will be reported on the seminar paper. Seminar presentation will also be evaluated. Assessment criteria will be given at the starting lecture and in the web-based learning environment of the course. Read more about assessment criteria at the University of Oulu webpage.
Grading:
Every member of the student group will get the same grade. The grade (scale 1-5) will be based 75% on the expertise in the topic and 25% on the oral presentation.

Person responsible:
Tonja Molin-Juustila
Working life cooperation:
No

815305A: Real Time Distributed Software Development, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Petri Pulli

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/135 hours of work
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. Interrupts
Characteristics of Distribution
1. Distribution architectures
2. Concept of time;
3. Synchronisation;
4. Latency and jitter;
5. Quality of service;
6. Service discovery;
7. Networking primitives

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 40h, design exercises 15h, student project 80h.
Prerequisites and co-requisites:
Student understands computer architecture, object-oriented analysis and design (UML), programming language C and/or Java.
Recommended or required reading:
Lecture notes based on reference books
- 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
Grading:
1-5
Person responsible:
Petri Pulli

815312A: Software Production and Maintenance, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Saukkonen, Samuli

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/133 hours of work
Timing:
1 st year of Master's and GS ^{3}D studies, spring semester, period 3
Learning outcomes:
After completing the course, the student:

- Can apply the framework of product line engineering in large scale software production;
- Can apply the maintenance process and techniques in software production.

Contents:
Product line engineering
  1. Product line variability;
  2. Domain engineering;
  3. Application engineering;
  4. Transition strategies and organisational issues.
Software maintenance
  1. Categories of maintenance;
  2. Corrective maintenance;
  3. Other forms of maintenance.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 20h, study group working and weekly discussion sessions with the teacher on 8 assignments, together with report writing, 113h.
Prerequisites and co-requisites:
 Basic knowledge of software engineering and software architectures.
Recommended or required reading:
- Pohl, K., Böckle, G., van der Linden, F. Software Product Line Engineering. Foundations, Principles, and Techniques, Springer-Verlag, 2005; chapters 1-5, 10, 15, 19-20.
- Chastek G.J., Donohoe P., McGregor J.D., Formulation of a Production Strategy for a Software Product Line, Technical Note CMU/SEI-2009-TN-025, Carnegie Mellon, 2009
- Gopalaswamy, R., Ramesh, B., Software maintenance: effective practices for geographically distributed environments, Tata McGraw-Hill, 2006 - Computers - 456 pages; chapters 1-6.

Assessment methods and criteria:
 Active participation: 8 weekly assignments to be assessed separately. The final grade will be the sum of all assignments. "Conventional" participation: written exam.
Grading:
1-5
Person responsible:
Samuli Saukkonen

815311A: Software Quality and Testing, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Burak Turhan

Opintokohteen kielet: English

Leikkaavuudet:

   ay815311A   Software Quality and Testing (OPEN UNI)   5.0 op

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
English
Timing:
 1 st year of Master's studies, autumn semester, period 1
Learning outcomes:
The student understands different views on software quality and the role of reviews, inspection and testing as a part of software engineering and defect removal techniques. The student can conduct the review as part of review team and use an appropriate supporting tool. The student knows testing levels, strategies and techniques, can create test cases and conduct unit testing with appropriate testing tools. The student knows the possibilities of test driven development, test automation and models for reviewing.
Contents:
Software quality and quality assurance. Software reviews and inspection. Fundamental concepts of software testing. Software testing techniques. Test-driven development. Test automation.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 32h, study group working 24h, paper reading 24h, exercises 24h, report writing 30 h
Target group:

Prerequisites and co-requisites:
Basic knowledge of software engineering, knowledge of Java programming language.
Recommended optional programme components:

Recommended or required reading:
To be announced during the course implementation but initially planned to be:
• Pezze M.,Young M., "Software Testing and Analysis: Process, Principles and Tech-niques", John Wiley&Sons, 2008
• A. P. Mathur, "Foundations of Software Testing", Prentice Hall, 2008
• Paul Ammann, Jeff Offutt, "Introduction to Software Testing", Cambridge University Press, 2008
• Kent Beck, "Test-Driven Development by Example", Addison-Wesley, 2002
• Lasse Koskela, "Test Driven: Practical TDD and Acceptance TDD for Java Devel-opers", Manning Publications, 2007
• Galin D., "Software Quality Assurance: From theory to implementation", Addison-Wesley, 2004
Assessment methods and criteria:
Report and exercise evaluation, active and regular attendance to lectures and exercises.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1–5
Person responsible:
 Burak Turhan
Working life cooperation:
No

812670S: The Next Generation of the Web, 5 op

Voimassaolo: 01.08.2011 -

Opiskelumuoto: Advanced Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Salman Mian

Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work
Language of instruction:
  English
Timing:
1 st – 2 nd year of Master's studies, spring semester, period 3
Learning outcomes:
After completing the course the student is able to:

- Apply the lessons learned for web design, organisational purposes and entrepreneurial activities; and
- Analyse issues related to web's development stages and trends and potentially even to predict potential future web;
- Develop businesses based on technology road mapping, scenario thinking, future forecasting, and research methods and theories of technological innovation and diffusion.

Contents:

The course will help the student to recognise and reflect on on-going and potential future web development trends. It will build upon understanding of the contemporary web, its conceptual background, and the changes that lead to the web we see today. The ultimate goal for the course is to foresee the potential future of the web for the upcoming five years. Thus, the name of the course is The Next Generation of the Web.

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
 Lectures/seminars 24h, independent work (reading and essay writing) 110h.
Target group:

Prerequisites and co-requisites:
Course "813619S Emerging Technologies and Issues" (strongly recommended).
Recommended optional programme components:

Recommended or required reading:
Scientific articles, the web. More sources to be announced specifically during the course implementation.
Assessment methods and criteria:
Participation in the lectures, student paper (only in English).

Read more about assessment criteria at the University of Oulu webpage.
Grading:
  1–5
Person responsible:
Salman Mian
Working life cooperation:
No

810020Y: Orientation Studies, 2 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: General Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
2 ECTS credits/53 hours of work.

Language of instruction:
finnish
Timing:
1 st year, autumn and spring semester, period 1 - 4.

Learning outcomes:
After passing the course a student:

- Recognises from the viewpoint of his/her university studies the actions and services of the most important units, organisations and societies and his/her action possibilities in them;
- Recognises the characteristics of the university-level studies, own curriculum and the discipline of Information Processing Science from the viewpoint of his/her studies and their planning;
- Is able to discuss on the purpose of his/her studies and the upcoming study path;
- Is able to create and present his/her own Personal Study Plan (PSP);
- Knows the city of Oulu and its services.

Contents:
1. Common occasions and lectures, 2. Small group activities (student tutoring), 3. PSP process, 4. Science library Tellus and Oula database, 5. Teacher tutoring.

Mode of delivery:
Face-to-face teaching and web-based teaching.

Learning activities and teaching methods:
Common occasions and lectures 16h, small-group activities (student tutoring) 15h, PSP process 4h, independent personal work 8h and teacher tutoring 10h.

Target group:
Bachelor students in Information Processing Science.

Recommended or required reading:
Lecture materials, www pages, study guides, brochures and forms.

Assessment methods and criteria:
Active participation in lectures, common occasions, small group activities (student tutoring) and teacher tutoring. Creating and returning PSP to WebOodi.

Grading:
Pass/fail

Person responsible:
Heli Alatalo

Working life cooperation:
No

902002Y: English 1 (Reading for Academic Purposes), 2 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Negotiated Education

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Proficiency level:
B2/C1 on the [Common European Framework of Reference](#) scale.
Status:
This course is mandatory for students of the following degree programmes:
Faculty of Science
•Biology
•Chemistry
•Mathematical Sciences
•Physics
Oulu Mining School
•Geosciences degree programme
Faculty of Information Technology and Electrical Engineering
•Department of Information Processing Science

Students in the Department of Geography take English 3.

Engineering students in the following programmes take their English courses in the Faculty of Technology:
Oulu Mining School:
• Mining Technology and Mineral Processing degree programme

Faculty of Information Technology and Electrical Engineering
•Department of Electrical Engineering
•Department of Communications Engineering
•Department of Computer Science and Engineering

Please consult the Faculty Study Guide to establish the language requirements for your own degree program.
Required proficiency level:
English must have been the A1 or A2 language at school or equivalent English skills should have been acquired otherwise.
ECTS Credits:
2 ECTS credits (total work load 54 hours including classroom meetings.)
Language of instruction:
English
Timing:
Biology: 1st year spring term
Chemistry: 1st year autumn term
Geology: 1st year spring term
Information Processing Science: 1st year spring term
Mathematical Sciences (pedagogy): 1st year spring term
Mathematical Sciences: 2nd year autumn term
Physical Sciences: 1st year autumn term
Learning outcomes:
By the end of the course, you are expected to be able to
- have acquired effective vocabulary learning techniques
- be able to distinguish parts of words to infer meanings
- utilize your knowledge of text structure and cohesion markers to understand academic texts
- extract information and learn content from English readings in scientific and professional contexts
Contents:

The course will focus on reading strategies; these include recognizing how texts are organized, identifying key points in a text, and understanding words in context. Vocabulary work in the course will focus on a) academic vocabulary, as used in formal scientific writing, and b) using your knowledge of the meanings of parts of words (affixes) to infer meaning.

Mode of delivery:
Contact teaching

Learning activities and teaching methods:
The scope of the course is 2 op (54 hours student workload).

Target group:
1st year students of Biology, Chemistry, Geology, Information Processing Science, Physics, and Mathematics (pedagogy); 2nd year students of Mathematics

Prerequisites and co-requisites:
-

Recommended optional programme components:
Students are also required to take 902004Y Scientific Communication, which is taken AFTER completion of this course.

Recommended or required reading:
Photocopies will be provided by the teacher and/or required texts will be accessible online or from the university library.

Assessment methods and criteria:
Student work is monitored by continuous assessment. You are required to participate regularly and actively in all contact teaching provided, and successfully complete all required coursework. There will be three monthly tests on material covered so far.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
Pass/Fail

Person responsible:
Karen Niskanen and Patrick Nesbitt

Working life cooperation:
-

Other information:
N.B. Students with grades *laudatur* or *eximia* in their A1 English school-leaving examination can be exempted from this course and will be granted the credits by the Faculty of Science.

902004Y: English 2 (Scientific Communication), 2 op

Voimassaolo: 01.08.1995 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Negotiated Education

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: English

Leikkaavuudet:

   ay902004Y   English 2 (Scientific Communication) (OPEN UNI)   2.0 op

Proficiency level:
B2/C1 on the CEFR scales

Status:
This course is mandatory for all 2nd year students (except **geographers**) who will have English as their foreign language in their B.Sc. degree. This includes the students who were exempted from 'Reading for Academic Purposes'(902002Y). Please consult the faculty study guide to establish the language requirements on your own degree programme.

Required proficiency level:
Students taking this course must have had English as the A1 or A2 language at school or the equivalent English skills should have been acquired otherwise. The course 'Reading for Academic Purposes' (902002Y) is a pre-requisite, unless exempted.

ECTS Credits:
The student workload is 53 hrs work/ 2 ECTS credits.

Language of instruction:
English

Timing:

Biology: 2nd year autumn term
Chemistry: 2nd year spring term
Geology: 2nd year spring term
Information Processing Science : 2nd year autumn term
Mathematics: 2nd year spring term
Physics: 2nd year autumn term
Learning outcomes:
By the end of the course, you are expected:
1. to have demonstrated your use of appropriate strategies and techniques for communicating effectively in English in an academic context.
2. to have demonstrated the ability to prepare and present scientific subjects to your classmates, using appropriate field-related vocabulary.
Contents:
Skills in listening, speaking, and presenting academic topics are practised in the classroom, where there is an emphasis on working in pairs and small groups. Homework tasks include online lecture listening and reading, preparation for classroom discussions and written work to support the classroom learning.
Mode of delivery:
Contact teaching
Learning activities and teaching methods:
Contact teaching 28 hours, homework 28 hours
Target group:
2nd year students of Biology, Chemistry, Geology, Information Processing Science, Mathematics, Physics
Prerequisites and co-requisites:
-
Recommended optional programme components:
Also required: 902002Y Reading for Academic Purposes Englannin kieli 1
Recommended or required reading:
Course materials will be provided by the teacher.
Assessment methods and criteria:
Continuous assessment is based on regular attendance, active participation in all lessons and the successful completion of all homework tasks.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Pass / fail.
Person responsible:
Karen Niskanen and Patrick Nesbitt
Working life cooperation:
-
Other information:
-

900095Y: Oral Communication, 2 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Negotiated Education

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Proficiency level:

-
Status:
This course unit together with the course unit 900094Y Written Communication I (TOL) are compulsory to students of Information Processing Science. The students can also opt to complete their oral communication studies by taking the course unit 900099Y Scientific Communication (TOL).
Required proficiency level:

-
ECTS Credits:
2 ECTS credits
Language of instruction:

Finnish
Timing:
2nd year of studies
Learning outcomes:
Upon completion of the course unit 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 be able to function purposefully in various situations where he/she is working by himself/herself or as a part of a group. He/she should be able to give, receive and process constructive criticism. The student should be able to critically evaluate his/her own oral communication skills and understand the significance of oral communication in university studies, scientific activity and as a part of his/her professional expertise.
Contents:
Presentation exercises, group work, communicator image and its significance, the speech communication situation and speech communication skills, structure of a speech, preparing a speech, goals and distinctive features of scientific interaction, communicating as an expert in scientific and professional contexts, procedures and practices in discussions, negotiations and meetings, observation and analysis of speech communication situations.
Mode of delivery:
multi-modal teaching
Learning activities and teaching methods:
Contact teaching 18 hrs, independent work 36 hrs.
Target group:
students of information processing science
Prerequisites and co-requisites:
-
Recommended optional programme components:
-
Recommended or required reading:
Material provided by teacher, subject to a charge
Assessment methods and criteria:
Participation to the contact teaching, independent work and completion of the given assignments
Read more about assessment criteria at the University of Oulu webpage.
Grading:
pass / fail
Person responsible:
Kaija-Mari Kananen
Working life cooperation:
-
Other information:
-

901049Y: Second Official Language (Swedish), Oral Skills, 1 op

Voimassaolo: 01.08.2014 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuyksikkö: Negotiated Education
Opintokohteen kielet: Swedish
Leikkaavuudet:

901061Y   Second Official Language (Swedish), Oral Skills   1.0 op
ay901049Y   Second Official Language (Swedish), Oral Skills (OPEN UNI)   1.0 op

901048Y: Second Official Language (Swedish), Written Skills, 1 op

Voimassaolo: 01.08.2014 -
Opiskelumuoto: Language and Communication Studies
Laji: Course
Vastuuyksikkö: Negotiated Education
Opintokohteen kielet: Swedish

Leikkaavuudet:

901060Y   Second Official Language (Swedish), Written Skills   1.0 op

ay901048Y   Second Official Language (Swedish), Written Skills (OPEN UNI)   1.0 op

900094Y: Written Communication, 2 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Language and Communication Studies

Laji: Course

Vastuuyksikkö: Negotiated Education

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Proficiency level:

-

Status:

This course together with the course unit 900095Y Speech Communication are compulsory to students of Information Processing Science. The students can also opt to complete their written communication studies by taking the course unit 900099Y Scientific Communication.

Required proficiency level:

-

ECTS Credits:

2 ECTS credits

Language of instruction:

Finnish

Timing:

2nd year of studies

Learning outcomes:

Upon completion of the course unit the student should be conversant with text analysis. The student should be able to write various work and study-related texts and act purposefully in different kinds of written communication situations. He/she should be able to give and receive constructive criticism. The student should be able to critically analyse his/her own writing process and the texts he/she produces. The student should understand the significance of writing skills as a part of his/her professional expertise.

Contents:

Notions about writing, writing as a process, group writing, critical and analytical reading, differend kinds of work and study-related texts, formal style.

Mode of delivery:

online teaching

Learning activities and teaching methods:

Introductory meeting (1 hour) and online studying (approximately 54 hours).

Target group:

the students of information processing science

Prerequisites and co-requisites:

-

Recommended optional programme components:

-

Recommended or required reading:

the material in the Optima learning environment

Assessment methods and criteria:

Participation in the introductory meeting, independent study and completion of given assignments.

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

Grading:

pass / fail

Person responsible:

Kaija-Mari Kananen

Working life cooperation:

-

Other information:

-

810122P: Computer Architecture, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Basic Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Oivo, Markku Tapani
Opintokohteen kielet: Finnish
Leikkaavuudet:

   521267A   Computer Engineering   4.0 op

ECTS Credits:
 5 ECTS credits/135 hours of work

Language of instruction:
finnish
Timing:
 1 st year, spring semester, period 3

Learning outcomes:
After completing the course, a student understands and manages the software platform for the performance of the structure and activities related to performance, resource needs, and error situations. Students master the basic vocabulary, which is able to communicate and document the software development, particularly in the nearby device applications such as embedded software, mobile systems, multimedia and scientific computing.

Contents:

1. Basics of digital logic and components of a processor
2. Display formats of digital information
3. The processor and its functions
4. The processor instruction set
5. Assembly language
6. Memory management
7. Input and output
8. Interrupts, device drivers and BIOS
9. Multimedia support
10. Mobile processors
11. Parallel computing

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 40h, home exercises 15h, laboratory exercises 15h, examination either through 2 intermediate exams (preparation 65h) or through final exam (preparation 65h)

Recommended or required reading:
Comer; D.E., Essentials of Computer Architecture. Pearson/Prentice Hall. ISBN 0-13-106426-7. 2005. 369 s.

Also examples of the following books are used in lectures **:**

- Tanenbaum A.S., Structured Computer Organizations. 4th Edition. Prentice Hall. 1999. 700 s.
- Stallings, W. Computer Organization and Architecture. 5th Edition. Prentice Hall. 2000. 768 s.

Assessment methods and criteria:
Examination

Grading:
1-5
Person responsible:

Petri Pulli

811120P: Discrete Structures, 5 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Vesanen

Opintokohteen kielet: Finnish

ECTS Credits:
 5 ECTS credits/134 hours of work
Language of instruction:
finnish
Timing:
1st year, period 1
Learning outcomes:
The student is able to interpret simple mathematical notation and write it by himself/herself. He/she can define the most important concepts that appear in the basic theoretical structures (see Contents) accurately and describe the idea of the definitions. The student also masters the most essential results and (algorithmic) methods of the basic structures and is capable of applying them in easy examples. He/she is able to evaluate certain kinds of simple practical problems in computer science, to choose appropriate theoretical methods to solve the problems, and finally to apply the chosen methods.

Contents:
1.   The concept of algorithm;
2.   Number systems and the conversion of bases;
3.   Logic (proposition calculus, predicate calculus basics);
4.   Set theory, relations and functions (finiteness/infinity, induction);
5.   Basic number theory (divisibility and the respective algorithms);
6.   Combinatory (principles of counting);
7.   Graph theory.
Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 40h, exercises 30h, autonomous work about 64h.
Prerequisites and co-requisites:
Mastering basic mathematical knowledge as is presented in the high school short mathematics syllabus.
Recommended or required reading:
Lecture slides (about 250 slides), lecture notes (about 100 pages), textbook: Peter Grossman, Discrete Mathematics for Computing, Second Revised Edition, Palgrave Macmillan, 2002. ISBN: 978-0333981115.
Assessment methods and criteria:
Lectures by final exam; mandatory exercises by self-contained work.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1-5
Person responsible:
Ari Vesanen
Working life cooperation:
No

811177P: Humans as Users and Developers of Information Technology, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Minna Isomursu

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay811177P   Humans as Users and Developers of Information Technology (OPEN UNI)   5.0 op

ECTS Credits:
5 ECTS credits/130 hours of work

Language of instruction:
finnish

Timing:
1 st year, autumn semester, period 2

Learning outcomes:
After completing the course, students will be able to examine humans as both users and developers of information technology. The student learns core concepts of the phenomenon, and understands their meaning in relation to practice. Students are also familiar with the background of usability research and some of its scientific theories. Students are able to observe and specify a variety of use situations and user experiences of information technologies. Students also understand the challenges of the information technology developers when targeting to create pleasant use experiences for the users of these technologies. After completing the course, students also realize they have started their own journey to become an expert in information technology development.

Contents:
The key themes and concepts of the course are the diversity of information technology, humans as users and developers of information technology, usability, use and user experience, user-centred design.

Mode of delivery:
Face-to-face teaching and self-studying supported with web-based learning environment.

Learning activities and teaching methods:
Lectures (24h), home assignments and written task based on required reading (about 106h).

Recommended or required reading:
Antti Oulasvirta (ed.): "Ihmisen ja tietokoneen vuorovaikutus" (2011), parts I and II. In addition, the material during lectures and other supplementary material.

Assessment methods and criteria:
Course assessment is mainly based on the pre-assignment, home assignments, and individual essay based on the required reading. In addition, one may improve one's own grade by optional advanced assignment. Assessment criteria will be available in the web-based learning environment.

Grading:
1-5

Person responsible:
Minna Isomursu

Working life cooperation:
No

811168P: Information Security, 5 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Mari Karjalainen

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay811168P   Information Security (OPEN UNI)   5.0 op

ECTS Credits:

5 ECTS credits/134 hours of work

Language of instruction:
Finnish
Timing:
2nd year, period 1
Learning outcomes:
After completing the course, a student remembers the main features of the history of information security and is able to define essential security concepts. She/he recognises the different phases of security systems development, is able to evaluate their contents and can describe the fundamental characteristics of planning for security. The student is capable on a basic level of analysing the main scientific methods of information security (risk management, encryption, authentication, access control, etc.) and can explain the functioning of the most important security algorithms and protocols. She/he is able to solve small-scale problems in encryption and authentication and can use security software tools whose functioning principles he/she understands.
Contents:
1. History and basic structures;
2. The need and concepts of information security;
3. Risk management;
4. Planning of security;
5. Cryptography;
6. Access control;
7. Security protocols;
8. Software security;
9. Implementing information security;
10. Information security maintenance.
Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 32h, exercises 32h, autonomous work about 64h
Target group:

Prerequisites and co-requisites:
Mastering the material presented in the courses "Discrete Structures" and "Internet and Computer Networks" is of use
Recommended optional programme components:

Recommended or required reading:
Lecture slides (about 250 slides), text book: M. Whitman and H. Mattord, H., *Principles of Information Security 2nd ed.*, Thomson Course Technology, Boston, 2005. ISBN 0-619-21625-5
Assessment methods and criteria:
lectures by final exam
Grading:
1-5
Person responsible:
Mari Karjalainen
Working life cooperation:
No

810136P: Introduction to Information Processing Sciences, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Kuutti, Kari Pekka Tapani

Opintokohteen kielet: Finnish

Leikkaavuudet:

   ay810136P   Introduction to information processing sciences (OPEN UNI)   5.0 op

ECTS Credits:
5 ECTS credits/135 hours of work
Language of instruction:

Finnish
Timing:
1st year of Bachelor studies, autumn semester, period 1
Learning outcomes:
Students are able to complete information searches belonging to subject areas related to the course, analyse the information they have found and write short reports and essays.
Contents:
The course consists of lectures of various aspects of computer science and current research. Practical working life is discussed from the information science point of view. The course also introduces scientific work and its sub-processes through listening, discussing, reading, critical and creative thinking, material search, structuring and writing papers.
Mode of delivery:
Blended teaching
Learning activities and teaching methods:
Lectures (24 h), exercise work (40 h), and self-study (71 h). The course uses a web-based learning environment for sharing information and exercises in support of reading.
Target group:

Recommended optional programme components:

Recommended or required reading:
Will be announced during the course.
Assessment methods and criteria:

Will be announced during the course.
Grading:
1 - 5
Person responsible:
Kari Kuutti

811167P: Introduction to Information Systems Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Mikko Rajanen

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay811167P   Introduction to Information Systems Design (OPEN UNI)   5.0 op

ECTS Credits:
 5 ECTS credits/136 hours of work

Language of instruction:
finnish
Timing:
 1 st year of Bachelor studies, period 3

Learning outcomes:

After completing the course, the student will be able to:
- Explain the main areas of the information system design on technical level, main design process models for the information system design, basics of the requirement gathering, basics of the information system initialization, and basics of how to evaluate information systems.;
- Produce use-case descriptions, use-case diagrams and other types of diagrams and descriptions needed to model the operational environment of the information system

Contents:

Basic concepts of Information Systems, Information System Design, Information System Modeling, Operational Environment Modeling, Process models for Information System Development, Evaluation of Information Systems

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (9x3h), Exercises (7x3h), Assignment (85h), Exam (3h).

Recommended or required reading:
Structure and contents of the course are based on:
- Satzinger, Jackson ja Burd (2007), Systems Analysis and Design in a Changing World
- Hoffer, George and Valacich (2008), Modern systems Analysis and Design, 5. revision

Assessment methods and criteria:
Exam and mandatory assignment

Grading:
1-5
Person responsible:
Mikko Rajanen

Compulsory

811167P-01: Introduction to Information Systems Design, exercise work, 0 op

Opiskelumuoto: Basic Studies
Laji: Partial credit
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

811167P-02: Introduction to Information Systems Design, exam, 0 op

Opiskelumuoto: Basic Studies
Laji: Partial credit
Arvostelu: 1 - 5, pass, fail
Opettajat: Mikko Rajanen
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

811122P: Introduction to Programming, 5 op

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

ay811122P   Introduction to Programming (OPEN UNI)   5.0 op

ECTS Credits:
5 ECTS
Language of instruction:
Finnish
Timing:
1st year, period 2

Learning outcomes:
Objective: Student can systematically design, accomplish and test simple programs using C-language as a target language.

Learning outcomes: After the course, the student:

- Understands the importance of design in programming;
- Can design and implement modular programs;
- Understands the principles of control structures and can exploit them;
- Understands the meaning on array constructions and can exploit them;
- Understands the meaning of pointers and can exploit them;
- Understands the meaning of data structures and can exploit them;
- Can manipulate text files programmatically.

Contents:
Contents:

- Software design method (waterfall)
- Problem solving
- Stepwise refinement
- Control structures
- Modular programming, calling modules, communication between modules
- Data types
- Arrays
- Pointers
- Character strings
- Data structures
- File processing

Learning activities and teaching methods:
Mode of delivery: Lectures and exercises
Target group:
Target group: Bachelor level students, compulsory
Recommended optional programme components:
-
Recommended or required reading:
Study materials: https://noppa.oulu.fi/noppa/kurssi/811122p/etusivu
Course book: Datel, Datel: C HOW TO PROGRAM; Pearson Education Inc. 2007
Assessment methods and criteria:
Assessment methods: two ways **:** 1. Final exam & exercise points; and 2. Weekly exams & exercise points
Grading:
1-5
Person responsible:
Ilkka Räsänen

811174P: Introduction to Software Business, 5 op

Opiskelumuoto: Basic Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Marianne Kinnula

Opintokohteen kielet: Finnish

Leikkaavuudet:

811178P   Technology Business and Innovations   5.0 op

ay811174P   Introduction to Software Business (OPEN UNI)   5.0 op

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
Finnish
Timing:

1st year, spring semester, period 4

Learning outcomes:
After completing the course, a student can:
• Explain how the industry is structured;
• Describe the software industry's business logic as typically used in business models and the reasoning behind their use;
• Describe the important areas of the software business.

Contents:
This course provides an overview of software business from three different viewpoints: software industry, business logic, and functions of a software company. The course topics include history of software business, structuring and clusters of software industry, business models in software industry, networking and outsourcing, growth and development of a software company, software marketing and sales, and internalization of a software company.
Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures (26-30h), exercises (20h), independent work (54-58h), take home examination (30h)
Target group:

Recommended optional programme components:
-
Recommended or required reading:
Kurssimateriaali ja siihen liittyvä kirjallisuus.
Assessment methods and criteria:
Assignments, take home examination.
Grading:
 1 - 5
Person responsible:
Marianne Kinnula

812339A: Advanced Object-Oriented Programming, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Antti Siirtola
Opintokohteen kielet: Finnish

ECTS Credits:
  5 ECTS credits/133 hours of work

Language of instruction:
finnish
Timing:
  2 nd year, spring semester, period 3

Learning outcomes:
After completing the course, the student can construct C++ programs that apply inheritance, composition, polymorphism, and generics. The student also can construct programs corresponding to given UML diagrams and vice versa. Furthermore, 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. Finally, the student can apply principles of software testing to an object-oriented program.

Contents:

Basics of programming in C++ language, Composition, inheritance and polymorphism, Connection of UML diagrams to C++ programs, Design patterns, Generics, C++ Standard Template Library and containers. Basics of testing of object-oriented programs.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 32h, laboratory exercises 21h, weekly assignments and independent work 80h

Prerequisites and co-requisites:
Course 812347A Object-oriented Programming, or similar knowledge.

Recommended or required reading:
- Erich Gamma, Richard Helm, Ralph Johnson & John Vlissides: Design patterns – Elements of reusable object-oriented software.
- Bruce Eckel: Thinking in C++ Volume 1, 2 nd edition.

Assessment methods and criteria:
Weekly assignments (preferred) or final exam + programming assignment

Grading:
0-5
Person responsible:
Antti Siirtola
Working life cooperation:
no

Compulsory

812339A-01: Advanced Object-Oriented Programming, exercise work, 0 op

Opiskelumuoto: Intermediate Studies
Laji: Partial credit
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

812339A-02: Advanced Object-Oriented Programming, exam, 0 op

Opiskelumuoto: Intermediate Studies
Laji: Partial credit
Arvostelu: 1 - 5, pass, fail
Opettajat: Antti Siirtola
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

811383A: Bachelor Thesis, 7 op

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

ECTS Credits:

7 ECTS credits/187 hours of work

Language of instruction:

Timing:
3rd year, timing is free
Learning outcomes:
After completing the course, a student is able to:

- Produce their own research work, stage a concrete plan and refine it as the work progresses;
- Find the source materials as well as the library electronic databases;
- Analyse scientific texts and make them a source of criticism;
- Produce well-structured scientific text;
- Identify their work against future problems;
- Ask for advice and the counsellor will use the guidance in favour of work-testing plan.

Contents:
Each student will be guided based on the research literature.
Mode of delivery:
Guided self-motivated work
Learning activities and teaching methods:
Students prepare calendars of work as part of the research plan. The student has personal meetings with the supervisor or instructor to discuss topic selection and scoping, the research plan, the final review of the literature and a thesis draft. The director, depending on the thesis, may also be associated with other students via meetings for interaction.
Target group:
Bachelor level students.
Prerequisites and co-requisites:
Compulsory basic studies in the major subject (about 60 credits) completed, in particular an introduction to research work-study modules to prepare the thesis for BSc. During the course or immediately after, the course is part of the pre-Master's thesis. Written final test conducted on the research topic.

Recommended optional programme components:

Recommended or required reading:
The student's self-written material, institution and the instructor advice and scientific research and support material. Written work must be in compliance with the institution's formal guidelines.

Assessment methods and criteria:

Course requires a Bachelor's thesis preparation. In addition, the course may be included in the pilot, as determined by scientific research-related tasks.
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Approved / failed
Person responsible:
Raija Halonen
Working life cooperation:
No

811395A: Basics of Databases, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Iisakka, Juha Veikko

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits/ 133 hours of studying

Language of instruction:
finnish
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 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), transactions.
Mode of delivery:
face to face
Learning activities and teaching methods:
 Lectures 45h, compulsory exercises 24h and (reading 20h) and exams 21h. Self-studying 23 h.
Prerequisites and co-requisites:
The student knows basics of programming.
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 five 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:
Jua Iisakka

811379A: Basics of Human Computer Interaction, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Anna-Liisa Syrjänen

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay811379A   Basics of Human Computer Interaction (OPEN UNI)   5.0 op

812327A   Introduction to HCI design   4.0 op

ECTS Credits:
5 ECTS credits/133 hours of work
Language of instruction:
Finnish
Timing:
2 nd year, spring semester, period 3
Learning outcomes:
After completing the course, a student is able to define the basic concepts of user interface design, introduce the basic design process and its steps, the most common design and evaluation methods and tasks, and apply them in the context of graphical user interface design from the viewpoint of a certain user group and system.

Contents:
The fundamental concepts of user interface design and usability evaluation; user-centred design process; evaluation of the user group's viewpoint and application to graphical interface design, structure and elements by prototyping and user-based evaluation; user interface description, universal design and user support.

Mode of delivery:
Face-to-face teaching, self-study
Learning activities and teaching methods:
Learning Activities and Teaching Methods: Lectures (21 h), assignments in exercises (24 h), individual and group tasks (88 h); or self-study: an opening lecture (2 h), one larger assignment (110 h) and individual tasks (21 h).
Target group:

Prerequisites and co-requisites:
Course "Humans as Users and Developers of Information Technology" (811171P) or similar knowledge.
Recommended optional programme components:

Recommended or required reading:
Dix et al. (2004, 3rd edition or later edition) Human-Computer Interaction and lecture and assignment materials.
Assessment methods and criteria:
Accepted assigments and individual tasks.

Grading:
1–5
Person responsible:
Anna-Liisa Syrjänen

Working life cooperation:
No

811344A: Basics of Statistical Data Analysis for Information Processing Science, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Jouni Markkula

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits/134 hours of work.
Language of instruction:
finnish
Timing:
The course is held in the spring semester, during period III. It is recommended to complete the course in the final phase of bachelor studies.
Learning outcomes:
After completion of the course, the student can identify and describe the basic properties and types of statistical data and is able to apply them in tasks related to information processing sciences. The student is able to specify metrics and handle statistical variables. She or he is also able to describe and analyse statistical data with basic methods and report the results. The student knows also basics of R-language and is able to use it for conducting statistical analysis.
Contents:
Types of statistical data, measurement and variables, data collection methods, sampling, management of statistical data, descriptive statistics, hypothesis testing, basics of data analysis, graphical presentation of statistical data, reporting of statistical analyses, basics of R.
Mode of delivery:
Face-to-face teaching.
Learning activities and teaching methods:
Lectures 36 h, exercises 18 h, independent work 80 h.
Target group:
Bachelor level students.
Recommended or required reading:
 Lecture slides, given literature and exercise tasks.
Literature:
  • Blaikie (2003), Analyzing Quantitative Data; Wild & Seber (2000), Chance Encounters; Venables, Smith & the R Core Team (2014), An Introduction to R
  • Other literature specified in the course

Assessment methods and criteria:
The course is evaluated based on passed exam and acceptable exercise tasks.
Grading:
1-5

Person responsible:
Jouni Markkula

Compulsory

811344A-01: Basics of Statistical Data Analysis for Information Processing Science, exercise work, 0 op

Opiskelumuoto: Intermediate Studies
Laji: Partial credit
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

811344A-02: Basics of Statistical Data Analysis for Information Processing Science, exam, 0 op

Opiskelumuoto: Intermediate Studies
Laji: Partial credit
Arvostelu: 1 - 5, pass, fail
Opettajat: Jouni Markkula
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

813316A: Business Process Modeling, 5 op

Voimassaolo: 01.08.2010 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Jukka Kontula
Opintokohteen kielet: English

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
English

Timing:
The course unit is held in the spring semester, during period 4. It is recommended to complete the course in the second year of Bachelor studies.
Learning outcomes:
After completing the course, students are able to model and develop business processes, as well as use a computer-based process modeling tool. The students are able to distinguish between business process change on the enterprise level, business process level and the implementation level, and to and evaluate these business process changes.

Contents:
Process architecture and how it can be fitted to the organisation, process modelling, process performance measurement, understanding process-related problems, process development, software tools for modelling and analysing processes, exercises.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:

Lectures 30h, exercises 12h, course assignments 45h, problem-based learning 27h, exam 20h. The course assignments will be done as group work, the lecture reflections and the exam will be done as individual work.
Target group:

Recommended optional programme components:
-
Recommended or required reading:
Harmon, Paul (2007). Business Process Change. A Guide for Business Managers and BPM and Six Sigma Professionals. Morgan Kaufmann Publishers.
Assessment methods and criteria:
This course unit utilizes continuous assessment. Lectures are voluntarily, but participation is highly recommended. The students will write lecture reflections, a problem-based learning report, and will create a process model with a software tool. In addition, there will be an exam at the end of the course, which will be assessed. 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:
Karin Väyrynen
Working life cooperation:
No

811312A: Data Structures and Algorithms, 5 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Ari Vesanen

Opintokohteen kielet: Finnish

Leikkaavuudet:

521144A   Algorithms and Data Structures   6.0 op

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
Finnish
Timing:
2nd year, autumn semester, period 2

Learning outcomes:
After completing the course, the student can describe the concept of algorithm and explain what correctness and time complexity of algorithms mean. Furthermore, the student is able to explain the design paradigms presented in the course and to describe the complexity classes of relevant sorting algorithms. The student can analyse simple algorithms, i.e. to prove their correctness and evaluate their time complexity. Moreover, the student is able to describe the basic data structures and apply essential graph algorithms. Finally, the student can construct suitable data structures and algorithms for given problems; the student can also justify the choice of a data structure or an algorithm for an application.

Contents:
The concept and analysis of algorithms, sorting and searching algorithms and their complexity, algorithm design paradigms, the concept of data structure and basic data struc-tures, hash tables, binary search trees, graphs and their algorithms.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Lectures 40h, exercises 24h, independent work 70h.

Target group:

Prerequisites and co-requisites:
Mastery of subject matter of the course "Discrete Structures" is required.
Recommended optional programme components:

Recommended or required reading:
Cormen, Leiserson, Rivest, Stein: Introduction to algorithms, 2nd edition, MIT Press 2001 (or later). From this edition chapters 1–4, 6–13, 15–16, 22–24, Appendix A and B are covered.
Assessment methods and criteria:
Exam+assignment
Grading:
1-5
Person responsible:
Ari Vesanen
Working life cooperation:
No

811394A: Database systems, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Iisakka, Juha Veikko

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits/ 133 hours of studying

Language of instruction:
finnish
Timing:
Spring.   Period 4.

Learning outcomes:
After completing the course, students have constructed a small database application. They are able to buil simple XML- database and they can use object-relational database with object oriented program.
In addition, they have knowledge of modern non-relational database solutions (such as data warehouses and NoSQL-databases) and they have commanding knowledge of making use of those non-relational databases (such as data mining and Big data techniques).

Contents:
Realational database application, Object- and XML extensions in relational databases. Modern database solutions and the use of them.

Mode of delivery:
Face to face
Learning activities and teaching methods:
Lectures 30h, compulsory computer exercises 54h, another exercises 21 h and self-study 32h.

Prerequisites and co-requisites:
Basics of database -course (such as 811380A) and Object oriented analysis and design course (such as 812346A) are compolsory prerequisities.

Recommended or required reading:
 Will be anounced in lectures.

Assessment methods and criteria:
Will be anounced in lectures.

Grading:
1-5

812332A: Information Systems Design, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Kaisu Juntunen
Opintokohteen kielet: Finnish

Grading:
1-5
Person responsible:
Kaisu Juntunen

812305A: Information Systems in Organisations, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Seppo Pahnila
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits/134 hours of work.

Language of instruction:
finnish
Timing:
1 st year of Bachelor level studies, fall semester, periods 1-2.

Learning outcomes:
After completing the course, the student

- Can explain the importance of information systems in organizations
- Can define the conditions for the successful operation of the information in the organization
- Can explain the main features of the development of information systems

Contents:
The basics issues of organization, structure, and operation, the basics of a digital organization, information types and roles of the organizations, interaction between information and organization, the role of information systems in the management of organizations and decision-making, formation of organizational knowledge and management, enterprise resource planning (ERP) systems, organizational reform of information systems and the economic importance of information systems.

Mode of delivery:
Face-to-face lectures. Individual lecture assignments. Each student write at minimum eight so called week essays of ten. Lectures and the subject of each essay are available in Optima learning environment. Students upload the essays into Optima.

Grading:
1-5
Person responsible:
Seppo Pahnila

521150A: Introduction to Internet, 5 op

Voimassaolo: 01.08.2012 -

Opiskelumuoto: Intermediate Studies

Laji: Course

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, period 4.
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, most important access networks, TCP/IP protocol stack and most important network layer and transport layer protocols, most important Internet applications, basics of Internet security and multimedia.
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 3 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:
-

811393A: Introduction to research work, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Halonen, Raija Helena

Opintokohteen kielet: Finnish

ECTS Credits:

5 ECTS credits/128 hours of work

Language of instruction:
Finnish
Timing:
3rd year of Bachelor studies, periods 1-3.
Learning outcomes:
After completing the course, the student is able to understand the role of research in the society and university, and he or she knows how the study carried out at the department is located in the discipline. The student can name the basic phases of research process and how they are related to each other. The student knows the importance of scientific publishing for the research; identifies different channels for publications; and can use at least two different ways to evaluate quality – the quality of the publication forum and the number of citations. The student understands scientific argumentation and its role in research; knows the parts of an argument; and can analyse simple arguments. The student knows the role of empirical material in research and knows some key means to collect and analyse research material. The student knows why certain methods are chosen.
The student is able to seek articles from databases and use searches.
Contents:
Research in general, scientific argumentation, collecting and analysing empirical material, information search, understanding research process, scientific publishing.
Mode of delivery:
Face-to-face teaching.

Learning activities and teaching methods:
Lectures 18 h, exercises 36h, independent work 74 h.
Target group:

Recommended optional programme components:
Tiedonhankintakurssi (030005P), Kirjallinen ja suullinen viestintä (900050Y) , LuK-tutkielma (811383A)
Recommended or required reading:
Lecture material and exercise material.

Assessment methods and criteria:
Participation in lectures and exercises, and a written exercise.
Grading:
1–5

Person responsible:
Raija Halonen
Working life cooperation:
No

812342A: Object Oriented Analysis and Design, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Iisakka, Juha Veikko

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay812342A   Object Oriented Analysis and Design (OPEN UNI)   5.0 op

ECTS Credits:
5 ECTS credits/133 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, start of the autumn semester
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

Learning activities and teaching methods:
 Lectures 30h, compulsory exercises and assignments 28h, independent work 85 h.

Prerequisites and co-requisites:
Course of elementary programming (such as 811192P Introduction of programming) is a compolsory prerequisite. Basic knowledge of object programming and information systems analysis and design are assumed.

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

812341A: Object-Oriented Programming, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Ilkka Räsänen

Opintokohteen kielet: Finnish

Leikkaavuudet:

   ay812341A   Object-oriented Programming (OPEN UNI)   5.0 op

ECTS Credits:
 5 ECTS credits/133 hours of work

Language of instruction:
finnish
Timing:
 1 st year, spring semester, period 4

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 Java programs that apply inheritance, composition, and polymorphism.

Contents:
Introduction to object-orientation, Basics of programming in Java language, Composition, inheritance and polymorphism, Java collections and exception handling.

Mode of delivery:
face to face
Learning activities and teaching methods:
Lectures 32h, laboratory exercises 21h, weekly assignments and independent work 80h

Prerequisites and co-requisites:
 Course Introduction to Programming or similar knowledge.
Recommended or required reading:
   • Timothy Budd: Introduction to object-oriented programming, 3 rd edition.
   • Vesterholm – Kyppö: Java-ohjelmointi 6. tai uudempi painos, luvut 1-11.

- Kurssin verkkomateriaali

Assessment methods and criteria:
Weekly assignments (preferred) or final exam + programming assignment

Grading:
1-5
Person responsible:
Ilkka Räsänen

Compulsory

812341A-01: Object-oriented programming, exercise work, 0 op

Opiskelumuoto: Intermediate Studies
Laji: Partial credit
Arvostelu: 1 - 5, pass, fail
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

812341A-02: Object-oriented programming, exam, 0 op

Opiskelumuoto: Intermediate Studies
Laji: Partial credit
Arvostelu: 1 - 5, pass, fail
Opettajat: Ilkka Räsänen
Opintokohteen kielet: Finnish

Ei opintojaksokuvauksia.

811366A: Project Work, 10 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Antti Siirtola
Opintokohteen kielet: Finnish
Leikkaavuudet:

811311A	Project Management Principles	3.0 op
811365A	Project I	7.0 op
811108P	Basics of Project Work and Management	3.0 op
811308A	Principles of Project Work	4.0 op

ECTS Credits:
10 op / 260 hours of work
Timing:
3rd year, spring semester, periods 3-4
Learning outcomes:
Upon completion of the course, the student will be able to
- tell about concepts and methods related to project work,
- explain the prerequisites of a successful software project,
- collect information and based on it, make project related decisions,
- apply theory on project work and management in practice,
- recognise risks of software projects and prepare for them,
- work as a member of a project team,

- communicate with stakeholders by using both written and spoken language and
- apply his/her experience on design, implementation and testing to forthcoming software and/or academic research projects.

Contents:
Project as a working method, project planning, implementation of a project, concluding a project, practical work in a software or academic research project.

Mode of delivery:
Face-to-face teaching and working in a project
Learning activities and teaching methods:
Lectures 20h, assignments 20h, practical project work 220h
Target group:
Bachelor level students
Prerequisites and co-requisites:
The compulsory prerequisites are Introduction to Programming, Object-Oriented Programming (812347A), Advanced Object-Oriented Programming, Object-Oriented Analysis and Design (812346A), Data Structures and Algorithms (811312A), Introduction to Information Systems Design (811169P), Basics of Databases (811380A) and Software Engineering (811335A). The prerequisites do not apply to students who have already completed a Bachelor's degree, a higher degree or another equivalent degree.
Recommended optional programme components:
The recommended prerequisites are User Interface Programming (811375A) and Database systems (811384A).
Recommended or required reading:
Lecture slides, R. Pressman, Software Engineering: A Practitioner's Approach. McGraw-Hill, 2005, the Project Manual of the department, all other material given/presented during the lectures
Assessment methods and criteria:
The assessment of the course unit is based on the learning outcomes of the course unit. The student must complete all assignments and work toward the completion of the project tasks for the required amount of time. The more detailed assessment criteria are available on the Noppa page of the course unit.
Grading:
Pass/fail
Person responsible:
Antti Siirtola and Tonja Molin-Juustila
Working life cooperation:
Yes, the students will work in projects ordered by customer organisations while simulating software development as authentically as possible in a real working environment.
Other information:
There will be a binding preregistration for the course in November.

811391A: Requirements Engineering, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Saukkonen, Samuli

Opintokohteen kielet: Finnish

Leikkaavuudet:

ay811391A   Requirements Engineering (OPEN UNI)   5.0 op

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
Finnish
Timing:
3 rd year, autumn semester, period 2
Learning outcomes:
After completing this course, the student can analyse the requirements from the problem-domain and solution-domain viewpoints, and understands the special issues associated with these viewpoints. The student can distinguish the roles of problem-domain and solution-domain requirements for the customer and developer; he/she is able to identify various project types and knows which requirement style fits best to each project type. The student will be

familiar with various requirement definition styles together with their pros and cons, and is able to use some of the most important definition styles. Several requirements of elicitation techniques will be added to the student's toolbox with the skills of mastering some of them. The principles of requirements management, validation and verification during the product life cycle will be familiar to the student at the end of this course.

Contents:
Concepts of problem and solution domain. Requirements in different use contexts. Description styles for functional and non-functional requirements. Validation and verification of requirements. Requirements negotiation and prioritisation. Release planning. Requirements management during the product life cycle.

Mode of delivery:
The tuition will be implemented as face-to-face teaching.

Learning activities and teaching methods:
Lectures 32h, weekly assignments and project assignment about 102h.
Target group:

Prerequisites and co-requisites:
We assume the basic skills from the following courses: "811169P Introduction to Information System Design", "812346A Object-Oriented Analysis and Design", "811380A Basics of Databases", "811335A Software Engineering" and "812334A Information Systems Planning".
Recommended optional programme components:

Recommended or required reading:
S. Lauesen, Software Requirements – Styles and Techniques. Pearson Education 2002; chapters 1–4 and 6–9. A.M. Davis, Just Enough Requirements Management, Dorset House Publishing 2005; parts. Lecture slides.

Assessment methods and criteria:
Two ways of passing:
1) Active participation: weekly assignments and project assignment (only for Finnish-speaking students)
2) Conventional exam
Read more about assessment criteria at the University of Oulu webpage.
Grading:
Active participation will be evaluated based on the weekly assignments and the project work; the scale will be 1–5. The exam will be evaluated on a scale of 1–5.

Person responsible:
Samuli Saukkonen
Working life cooperation:
No

815345A: Software Architectures, 5 op

Voimassaolo: 01.08.2015 -
Opiskelumuoto: Intermediate Studies
Laji: Course
Arvostelu: 1 - 5, pass, fail
Opettajat: Juustila, Antti Juhani
Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
Finnish
Timing:
3 rd year, periods 3-4
Learning outcomes:
 The course aims to give an overview of concepts and techniques related to software architectures. The emphasis is on object-oriented systems but generic architectural models and techniques are discussed, too. After the course, the student is able to identify and analyse different software architecture solutions and understands the pros and cons of

each solution from the perspective of building and executing the software, as well as from the viewpoints of quality and maintainability. The student is able to describe software architecture solutions and the elements of such, including the interfaces between the elements, using UML. The student is able to create alternative architectural solutions based on the functional and non-functional requirements of the software, and evaluate the suitability of the solution regarding the purpose of the software. The student is able to identify the differences between the design of product/product family architectures with conventional software architectures

Contents:
The fundamentals of software architectures. Documenting software architecures. Components and interfaces. Dependencies in software. Design patterns. Architectural styles. Product line architectures. Frameworks. Evaluating software architectures.

Mode of delivery:
Face-to-face teaching.
Learning activities and teaching methods:
 Lectures 24h, exercises 20h, assignment 90h

Target group:
 Bachelor level students
Prerequisites and co-requisites:
General knowledge of software development, UML basics and general experience with object-oriented programming (included in courses: 811335A Software Engineering, 812346A Object-oriented Analysis and Design, 812347A Object-oriented Programming).
Recommended optional programme components:
 Advanced Object-oriented Programming is a recommended prerequisite.
Recommended or required reading:
   • Robert Hanmer: Pattern-Oriented Software Architecture For Dummies, 2013
   • K. Koskimies, T. Mikkonen: Ohjelmistoarkkitehtuurit. Talentum 2005;
   • L. Bass, R. Clements, R. Kazman: Software Architecture in Practice. Addison-Wesley 2003;
   • Other material announced **.**
Assessment methods and criteria:
The assessment of the course unit is based on the learning outcomes of the course unit. The student must pass the exercises and the assignments. The more detailed assessment criteria are available on the Noppa page of the course unit.
Grading:
Fail, 1-5
Person responsible:
Antti Juustila
Working life cooperation:
No

811346A: Software Engineering, 5 op

Voimassaolo: 01.08.2015 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Lappalainen, Jouni Esko Antero

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS

Language of instruction:
Finnish
Timing:
2 nd year, period 2
Learning outcomes:
After completing the course, a student is able to explain various aspects of software engineering areas such as process models, requirement specification, analysis and design methods, quality management and project

management, their importance and know how to use them for small-scale task solving. A student is familiar with software engineering practices and activities (review, testing, software product management, risk management, project management) and knows how to use them in software development at different levels. A student can explain the maintenance and redesign of software evolution and its importance.

Contents:
Software process, software requirements, software design methods, software engineering practices, software quality management, software project management

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:
Implementation methods of the course vary: a) Lectures 32h, exercises 24h, study group working 40h, assignment 40h and self-study 24h; b) Lectures 32h, exercises 24h, exam 64h, assignment 40h; c) Lectures 32h, exercises 24h, essay 64h, assignment 40h.

Prerequisites and co-requisites:
Course "811169P Introduction to Information Systems Design" and "812346A Object Oriented Analysis and Design" or similar knowledge.

Recommended optional programme components:

Recommended or required reading:
Pressman R., Software Engineering, A Practitioner's Approach, 7 th edition, McGraw-Hill, 2010, lecture material

Assessment methods and criteria:
Exam and assignment, exam can be replaced by study group work or essay.
Read more about assessment criteria at the University of Oulu webpage.

Grading:
1-5

Person responsible:
Jouni Lappalainen

Working life cooperation:
No

811375A: User Interface Programming, 5 op

Voimassaolo: 01.08.2010 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opettajat: Lappalainen, Jouni Esko Antero

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits/134 hours of work

Language of instruction:
Finnish

Timing:
3 rd year, autumn semester, periods 1 + 2

Learning outcomes:
After completing the course, the student can implement a software application that utilises a database for storage and has a graphical user interface. The GUI (as well as the entire application) must be developed by implementing usability design principles from the beginning of the development process.

Contents:
The course deals with the following: UI elements, foundations of the Swing library, UI design principles, layout managers, MVC-paradigm, event-driven programming, web-usability, JSP, programmatically utilising databases, JDBC, web-programming.

Mode of delivery:
Face-to-face teaching

Learning activities and teaching methods:

Exercise 33h, coursework 75h, independent study 26h.
Target group:

Prerequisites and co-requisites:
Knowledge and skills of the course "811380A Basics of Databases" and fundamentals of user interface design. In addition, the knowledge and skills of object-oriented programming are needed.
Recommended optional programme components:

Recommended or required reading:
Lectures in textual format within the course web space. In addition (if needed), for example Kosonen, Peltomäki & Silander (2005). Java 2 ohjelmoinnin peruskirja. Docendo. In addition, Lauesen, S. 2005. User Interface Design: A Software Engineering Perspective.
Assessment methods and criteria:
The student must submit coursework that fulfils the given requirements (defined during the course).
Read more about assessment criteria at the University of Oulu webpage.
Grading:
1–5 / fail
Person responsible:
Jouni Lappalainen
Working life cooperation:
No

030005P: Information Skills, 1 op

Opiskelumuoto: Basic Studies

Laji: Course

Vastuuyksikkö: Faculty of Technology

Arvostelu: 1 - 5, pass, fail

Opettajat: Sassali, Jani Henrik, Ursula Heinikoski

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:
-

Tutkintorakenteisiin kuulumattomien opintokokonaisuuksien ja -jaksojen kuvaukset

814311A: Internship in ICT-duties, 3 - 5 op

Opiskelumuoto: Intermediate Studies

Laji: Practical training

Arvostelu: 1 - 5, pass, fail

Opettajat: Tonja Molin-Juustila

Opintokohteen kielet: Finnish

ECTS Credits:
1-5 ECTS credits/1 – 4 months of full time work
Language of instruction:
Internship guidelines, report template and documentation in Finnish or in English.
Timing:
Recommended to take as a summer course, suitable for the supported work placement studies.
Learning outcomes:
During an internship period a student works in typical professional ICT duties to develop expertise in this field, practicing the work, its description and analysis, by applying what s/he has learned in Bachelor and/or Master level studies.
Contents:
Training one to four months in professional ICT duties that include orientation with the tasks and guiding when needed. Description and analysis of training by reporting.
Mode of delivery:
The student makes the needed arrangements for internship, negotiates job contract with an employer, makes the support application as needed, follows the agreed labor agreement, works within the agreed duties, studies independently the needed professional skills and knowledge, and documents and describes the internship in a report.

Learning activities and teaching methods:
Internship agreement, support application, internship, reporting.
Prerequisites and co-requisites:
Information Processing Science or related studies, which enable their practical application in the context of professional ICT duties.
Recommended or required reading:
Course materials related to the internship duties.
Assessment methods and criteria:
Internship is proved by delivering a signed letter of reference from the employer. The letter of reference contains details of the internship period and the student's primary duties. An internship report consists of description of realized work and analysis of learning outcomes in relation to the taken studies in Information Processing Science. The studies are proved by delivering an up-to-date transcript of records. Internship can be realized in several periods, which all are proved with the letter of reference and reported as soon as possible after the internship period.
Grading:

Pass/fail
Person responsible:
Tonja Molin-Juustila
Working life cooperation:
Working on professional ICT tasks
Other information:
Report guidelines and template from Optima; the support application will be recorded in SoleMOVE with the copy of the agreement; letter of reference from the employer and internship period will be recorded together with credits.

815338A: Principles of Programming Languages, 5 op

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

ECTS Credits:
5 ECTS credits/135 hours of work
Timing:
2 nd year, spring semester, period 3
Learning outcomes:
After completing the course, the student is able to explain the general principles and structures concerning design and implementation of programming languages. Furthermore, the student can compare properties of different programming languages. The student is able to explain the influence of aforementioned principles on usage and implementation of a programming language. Moreover, the student masters the basics of imperative programming and can describe the principle ideas of abstract data types, object-oriented programming, and exception handling. The student can explain the basic concepts of functional programming, logic programming and concurrent programming.
Contents:
History of programming languages, Syntax and semantics of programming languages, Abstract data types and object-oriented programming, Exception handling, Logic programming, Concurrent programming.

Mode of delivery:
Face-to-face teaching
Learning activities and teaching methods:
Lectures 32h, laboratory exercises 21h, and independent work 82h
Prerequisites and co-requisites:
Courses "Introduction to Programming", "Programming Assignment", or similar knowledge.

Recommended or required reading:
  • Sebesta, Robert W.: Concepts of Programming Languages 5th edition, Addison-Wesley 2002 (or later).
  • Harsu, Maarit: Ohjelmointikielet, Periaateet, käsitteet, valintaperusteet, Talentum 2005.
Assessment methods and criteria:
Final exam.
Grading:
1-5
Person responsible:
Ari Vesanen
Working life cooperation:
No

812315A: Software Construction, 10 op

Voimassaolo: 01.08.2014 -

Opiskelumuoto: Intermediate Studies

Laji: Course

Arvostelu: 1 - 5, pass, fail

Opintokohteen kielet: Finnish

Person responsible:
Antti Siirtola