# Opasraportti

# ITEE - Information Processing Science DP (2020 - 2021)

**University’s new study guide for academic year 2020-2021 is published at https://opas.peppi.oulu.fi**

**The study guide includes information on degrees, curriculums, courses and course timetables. Course registrations are still done in Oodi.**

**If you have questions on information in the study guide, please contact the study field's Academic Affairs Service Team https://www.oulu.fi/forstudents/faculty-study-affairs**

# Tutkintorakenteet

## Master's Degree Programme in Software, Systems and Service Development (GS3D), MSc

Tutkintorakenteen tila: published

Lukuvuosi: 2020-21

Lukuvuoden alkamispäivämäärä: 01.08.2020

### Common Studies (60 op)

900013Y: Beginners' Finnish Course 1, 3 op
813607S: IPS (TOL), Maturity Test for Master's Degree, 0 op
813613S: Master's Thesis, 30 op
813627S: Master's Thesis Seminar, 2 op
811371A: Preparatory Course for MSc Studies, 5 op
817609S: Project Seminar, 3 op
813621S: Research Methods, 5 op
817612S: Research and Development Project, 10 op
900017Y: Survival Finnish, 2 op

### Orientation Studies: Choose one orientation (30 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 Orientation**

811602S: Advanced Software Quality and Security, 5 op
811373A: Professional Software Engineering Processes and Human Factors, 5 op
811372A: Software Development, Maintenance and Operations, 5 op
811603S: Software Platforms and Ecosystems, 5 op
811604S: Software for Intelligent Systems and Artificial Intelligence (AI), 5 op
811605S: Software-Defined Products, Systems and Services, 5 op

**Information Systems Orientation**

817615S: Creating Domain Value with Data, 5 op
812352A: Digitalisation and Innovation, 5 op
817618S: Information Systems Strategy and Leadership, 5 op
812354A: Servitisation, Co-Creation and Business Development, 5 op
817619S: Societal and Individual Impacts of Information Systems, 5 op
812355A: User Experience (UX) Design and Management, 5 op

## Specialisation Studies: Select at least one specialisation (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.

**Software Engineering Specialisation**

811606S: Next Generation Software Engineering, 5 op
815663S: Software Engineering Research, 5 op

**Human-Centered Design and User Experience Specialisation**

812650S: Advanced Topics in Digital Cultures and Design, 5 op
812671S: User Experience (UX) and Usability Evaluation, 5 op

**Persuasive Design Specialisation**

812651S: ICT and Behaviour Change, 5 op
811607S: Persuasive Systems Design, 5 op

## Optional studies (including possible Minor Subject) (25 op)

812649S: Advanced Research Methods, 5 op
811330A: Project management, 5 op
816630S: Scientific paper writing, 1 - 3 op
811610S: Special Course in Information Processing Science 1, 5 - 10 op
814601S: Work Experience in ICT responsibilities, 5 op

# Degree Programme in Information Processing Science, Bachelor Level Studies, LuK

Tutkintorakenteen tila: published

Lukuvuosi: 2020-21

Lukuvuoden alkamispäivämäärä: 01.08.2020

## General and Language Studies (13 op)

902165Y: English Communication for Information Processing, Oral Skills, 3 op
902164Y: English Communication for Information Processing, Reading for Academic Purposes, 2 op
030005P: Information Skills, 1 op
900105Y: Launch your career through communication, 5 op
810020Y: Orientation Studies, 2 op
901049Y: Second Official Language (Swedish), Oral Skills, 1 op
901048Y: Second Official Language (Swedish), Written Skills, 1 op

## Introduction Module (22 op)

811102P: Devices and Data Networks, 5 op
811168P: Information Security, 5 op
810136P: Introduction to Information Processing Sciences, 5 op
811174P: Introduction to Software Business, 5 op

## Software Development Module (30 op)

811319A: Data Modeling and Design, 5 op
811103P: Introduction to Software Engineering, 5 op
811391A: Requirements Engineering, 5 op
815345A: Software Architectures, 5 op
811301A: Software Modeling and Design, 5 op
811306A: Software Quality and Testing, 5 op

## Programming Module (30 op)

811312A: Data Structures and Algorithms, 5 op
811325A: Databases, 5 op
811104P: Programming 1, 5 op
811322A: Programming 2, 5 op
811367A: Programming 3, 5 op
811368A: Programming 4, 5 op

## Humans, Organisation and Design of Information Systems Module (30 op)

812362A: Business Process Management and Modelling, 5 op
812364A: Data Analytics and Business Intelligence, 5 op
811166P: Fundamentals to Information Systems, 5 op
812363A: Human-Centred Design, 5 op
812361A: Information Systems Acquisition, Deployment and Management, 5 op
812360A: Information Systems Modelling, Desing and Development, 5 op

## Capstone Module (25 op)

813307A: IPS (TOL), Maturity Test for Bachelor ‘s Degree, 0 op
811383A: Bachelor Thesis, 7 op
811398A: Bachelor's project, 8 op
811397A: Basics of Project Work, 5 op
811393A: Introduction to research work, 5 op

## Optional Studies (including possible Minor Subject and Exchance Period) (30 op)

Optional Studies (including possible Minor
Subject and Exchance Period)

# European Masters in Software Engineering (EMSE) Second Year in Oulu

Tutkintorakenteen tila: published

Lukuvuosi: 2020-21

Lukuvuoden alkamispäivämäärä: 01.08.2020

## Common Studies (43 op)

813607S: IPS (TOL), Maturity Test for Master's Degree, 0 op
813613S: Master's Thesis, 30 op
817609S: Project Seminar, 3 op
817612S: Research and Development Project, 10 op

## Optional courses, suggestions (12 op)

813627S: Master's Thesis Seminar, 2 op
813621S: Research Methods, 5 op
811610S: Special Course in Information Processing Science 1, 5 - 10 op

## Software Engineering Orientation (5 op)

815663S: Software Engineering Research, 5 op

# Degree Programme in Information Processing Science, Master's Level Studies McS

Tutkintorakenteen tila: published

Lukuvuosi: 2020-21

Lukuvuoden alkamispäivämäärä: 01.08.2020

## Common Studies (55 op)

813607S: IPS (TOL), Maturity Test for Master's Degree, 0 op
813613S: Master's Thesis, 30 op
813627S: Master's Thesis Seminar, 2 op
811371A: Preparatory Course for MSc Studies, 5 op
817609S: Project Seminar, 3 op
813621S: Research Methods, 5 op
817612S: Research and Development Project, 10 op

## Orientation Studies: Choose one orientation (30 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 Orientation

811602S: Advanced Software Quality and Security, 5 op
811373A: Professional Software Engineering Processes and Human Factors, 5 op

811372A: Software Development, Maintenance and Operations, 5 op
811603S: Software Platforms and Ecosystems, 5 op
811604S: Software for Intelligent Systems and Artificial Intelligence (AI), 5 op
811605S: Software-Defined Products, Systems and Services, 5 op

**Information Systems Orientation**

817615S: Creating Domain Value with Data, 5 op
812352A: Digitalisation and Innovation, 5 op
817618S: Information Systems Strategy and Leadership, 5 op
812354A: Servitisation, Co-Creation and Business Development, 5 op
817619S: Societal and Individual Impacts of Information Systems, 5 op
812355A: User Experience (UX) Design and Management, 5 op

### Specialisation Studies: Select at least one specialisation (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.

**Software Engineering Specialisation**

811606S: Next Generation Software Engineering, 5 op
815663S: Software Engineering Research, 5 op

**Human-Centered Design and User Experience Specialisation**

812650S: Advanced Topics in Digital Cultures and Design, 5 op
812671S: User Experience (UX) and Usability Evaluation, 5 op

**Persuasive Design Specialisation**

812651S: ICT and Behaviour Change, 5 op
811607S: Persuasive Systems Design, 5 op

### Optional studies (including possible Minor Subject) (25 op)

812649S: Advanced Research Methods, 5 op
811330A: Project management, 5 op
816630S: Scientific paper writing, 1 - 3 op
811610S: Special Course in Information Processing Science 1, 5 - 10 op
814601S: Work Experience in ICT responsibilities, 5 op

# Opintojaksojen kuvaukset

## Tutkintorakenteisiin kuuluvien opintokohteiden kuvaukset

### 900013Y: Beginners' Finnish Course 1, 3 op

**Voimassaolo:** 01.08.1995 -
**Opiskelumuoto:** Language and Communication Studies
**Laji:** Course

**Vastuuyksikkö:** Languages and Communication

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay900013Y Beginners' Finnish Course 1 (OPEN UNI) 2.0 op

**Proficiency level:**
A1 (target level A1.2)
**Status:**
The course is intended for the international students in every faculty of Oulu University.
**Required proficiency level:**
A1.1, Completion of the Survival Finnish course (900017Y) or the equivalent language skills.
**ECTS Credits:**
3 ECTS credits
**Language of instruction:**
As much Finnish as possible; English will be used as a help language.
**Timing:**
-
**Learning outcomes:**
By the end of the course the student can understand and use some familiar and common everyday expressions relating to her/himself and everyday situations. S/he can interact in a simple way provided the other person talks slowly and clearly and is willing to help. The student is able to read short simple texts and messages dealing with familiar topics. S/he also deepens her/his understanding of the Finnish language and communication styles.
**Contents:**
This is lower elementary course which aims to help students to learn communication skills in ordinary everyday situations. During the course, students broaden their vocabulary and knowledge of grammar and principles of pronunciation. They also practise to understand easy Finnish talk about everyday subjects, and reading and writing short and simple texts/messages.

The topics and communicative situations covered in the course are: talking about oneself, one's family, studies and daily routines, as well as asking about these things from other person; expressing opinions; food, drink and transactions in the grocery; accommodation and describing it; colours and adjectives.

The structures studied are: verb types, basics of the change of the consonants k, p and t in verbs and nouns, basics of the partitive and genitive cases, possessive structure, some declension types for nouns (word types) and the basics of the local cases.
**Mode of delivery:**
Contact teaching and guided self study
**Learning activities and teaching methods:**
Lessons 2 times a week (26 h, including the final exam) and guided self study (55 h)
**Target group:**
International degree and post-graduate degree students, exchange students and the staff members of the University.
**Prerequisites and co-requisites:**
Completion of the Survival Finnish Course
**Recommended optional programme components:**
-
**Recommended or required reading:**
Kuparinen, K. & Tapaninen, T. Oma suomi 1 (chapter 2 - 5)
**Assessment methods and criteria:**
Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.
**Grading:**
Grading scale is 1-5.
**Person responsible:**
Anne Koskela
**Working life cooperation:**
-
**Other information:**
Sign-up in WebOodi or Tuudo. The course will start right after the Survival Finnish course.

## 813607S: IPS (TOL), Maturity Test for Master's Degree, 0 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
0 ECTS credits
**Language of instruction:**
Finnish / English
**Timing:**
The course is completed when the Master's Thesis is finalised.
**Learning outcomes:**
According to the Government Decree on University Degrees (794/2004), to be awarded a higher university degree, the student write a maturity essay which demonstrates conversance with in the topic of the thesis and skills in the use of Finnish or Swedish. When a student has been educated in a language other than Finnish or Swedish or a student has been educated abroad, the university shall determine separately the language of the maturity essay.
The student need not demonstrate command of the Finnish or Swedish language in the maturity essay included in the higher university degree if he/she has demonstrated his/her command of the language in a maturity essay included in a lower university degree studied in same language.
**Contents:**
Relevant to the topic of the thesis.
**Mode of delivery:**
Self study
**Learning activities and teaching methods:**
The maturity essay is approximately one concept paper (ie four pages or about 500 words). The text should be in the form of an essay addressing the topic of the thesis, and it should be analytical and coherent. In the maturity test, the student presents and analyzes his / her research materials, methods and results.
If the student is not required to demonstrate command of the Finnish or Swedish language, an abstract of the Master' s thesis will be accepted as showing the required competence instead of writing the text for the maturity test. The student has to write the abstract in a separate form that includes special guidelines for the maturity test. In this case the text does not have to prove the language skills of the student in Finnish or Swedish. However, the text must still show knowledge of the student's field of study.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
Master's Thesis accepted or almost finished.
**Assessment methods and criteria:**
The title of the maturity essay is determined and the essay is evaluated by the Master's Thesis supervisor. A maturity essay may be rejected if it contains significant and repetitive grammatical or other errors.
If the student is not required to demonstrate command of the Finnish or Swedish language, the required abstract form is delivered to the supervisor.
**Grading:**
Pass or fail
**Person responsible:**
The supervisor of the Master's Thesis

## 813613S: Master's Thesis, 30 op

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

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

**Language of instruction:**
Finnish / English
**Timing:**
Timing of the course is free. It is recommend to complete the thesis at the 2nd autumn semester of the Master's Studies.
**Learning outcomes:**
After completing the thesis, the student will be able to:
* 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 programme guidelines, as well as
* participate in the evolution of ICT and postgraduate studies after completing the thesis.
**Contents:**
Independent research work under supervision aiming at Master's Thesis
**Mode of delivery:**
Self study
**Learning activities and teaching methods:**
Conducting and reporting research work under supervision.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Research Methods.
**Assessment methods and criteria:**
The main supervisor and a second independent reviewer will evaluate the thesis according to the programme's criteria for the Master's Theses.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Researchers and teachers working in the research units in the area of Information Processing Science and qualified as a supervisors according to the programme's criteria.
**Working life cooperation:**
It is recommend choosing a topic that is of interest to a business.

## 813627S: Master's Thesis Seminar, 2 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Henrik Hedberg

**Opintokohteen kielet:** English

**Required proficiency level:**

**ECTS Credits:**
2 ECTS credits / 53 hours of work
**Language of instruction:**
English
**Timing:**
The course is held throughout the study year, in all periods. It is recommended to start the course during the 1st study year of the Master's studies, before Master's Thesis.
**Learning outcomes:**
After completing the course, the student will be able to:
* plan a scientific study,
* present own research in various stages, and
* give feedback of peers' research plans and results.
**Contents:**
The course consists of three phases following the structure and progress of a Master's Thesis work:
* previous research and initial research methods,

* data gathering and analysis, as well as
* discussions and conclusions (thesis).
In each phase, a student is required to participate first as a peer reviewer, and then present his/her own research. The course begin with familiarising students with the current reserach topics and methods of the degree programme.
**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Planning and presenting the student’s own research and giving feedback of peers' plans and results 53 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Research Methods
**Recommended optional programme components:**
813613S Master’s Thesis.
**Recommended or required reading:**
Guidelines to producing a Master’s thesis.
**Assessment methods and criteria:**
Acting as a presenter, peer reviewer and audience, as well as compliting the online tasks of an author and a peer reviewer.
**Grading:**
Pass or fail.
**Person responsible:**
Henrik Hedberg
**Working life cooperation:**
Acting as a presenter, peer reviewer and audience, as well as compliting the online tasks of an author and a peer reviewer.

## 811371A: Preparatory Course for MSc Studies, 5 op

**Voimassaolo:** 01.01.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Helena Tokkonen

**Opintokohteen kielet:** English

**Leikkaavuudet:**

811392A Preparatory Course for MSc Studies 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 1. It is recommended to complete the course in the 1st autumn semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* participate in courses requiring basic knowledge of project work,
* 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,
* define the principles of project coordination and communication with the project interest groups,
* consider the principles of referenced and scientific writing, as well as
* use APA referencing.
**Contents:**
The course consists of two parts: project management and scientific writing. In the project part we focus on the people, process and tools of projects in the 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). In the scientific writing part, 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.
**Learning activities and teaching methods:**
Blended teaching online lectures 20 h, independent learning methods 35 h, group work 75 h.
**Target group:**
Msc students
BSc degree from a University of Applied Sciences, a foreign university, etc.
Master's students who have no basic knowledge of project management and/or scientific writing and/or literature reviewing.
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree
**Recommended optional programme components:**
Especially recommended to take before Master's level project courses.
**Recommended or required reading:**
All material is provided during the course.
**Assessment methods and criteria:**
Active study of online lecture materials, weekly exercises, learning diary and participation in group work assignments.
**Grading:**
Pass or fail
**Person responsible:**
Helena Tokkonen
**Other information:**
Topic: Preparatory Course for MSc Studies Introduction lecture
Time: Sep 2, 2020 02:00 PM Helsinki
Join Zoom Meeting
https://oulu.zoom.us/j/61750761276
Meeting ID: 617 5076 1276
Other information can be found from Moodle. Enrolment key for the course is PCFMS.

## 817609S: Project Seminar, 3 op

**Voimassaolo:** 01.08.2013 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tonja Molin-Juustila

**Opintokohteen kielet:** English

**ECTS Credits:**
3 ECTS credits / 80 hours of work.
**Language of instruction:**
English.
**Timing:**
The timing of the course is dependent on the Research and Development Project course and must be taken at the same time with it. The course is held in the spring semester, during period 4. It is recommended to complete the course in the 2nd spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the students will be able to:
* demonstrate abilities to gain academic expertise in some challenging topic area of an ICT project,
* search research articles and literature on a ICT topic (review),
* apply research articles and other new knowledge like an academic expert in a selected topic of a project ("Research and Development Project" course),
* analyse and report practical experiences gained during the project as experience-based new data on the topic to peer students,

* 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, as well as
* act as reflective, independent academic expert in ICT project.

**Contents:**
Starting lecture, independent analysis and reporting of the expertise on the selected project topic and an expert seminar (2 full days) with the presentations of each topic.
**Mode of delivery:**
Blended teaching.
**Learning activities and teaching methods:**
Attendance at the starting lecture (4 h) and the expert seminar (2 full days) is mandatory. Independently writing the seminar paper and preparing the seminar presentation (abt. 60 h).
**Target group:**
MSc students.
**Prerequisites and co-requisites:**
It is required that the student is taking the Research and Development Project at the same time.

**Recommended or required reading:**
Research articles and materials are to be independently 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 in detail will be given at the starting lecture and in the web-based learning environment for the course.
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Tonja Molin-Juustila
**Working life cooperation:**
Seminar topics are related to the Master's students projects all of which are authentic project works in unique R&D project assignments from a real client (univerisity, companies and organizations like schools, library etc.)
**Other information:**
Enrollment by contacting the responsible person of the course and outlining a draft of the seminar paper before the starting lecture of the course, i.e. until the end of the period 3.

## 813621S: Research Methods, 5 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Netta Iivari

**Opintokohteen kielet:** English

**Leikkaavuudet:**

521146S Research Methods in Computer Science 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course in the 1st spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will able to:
* explain the general principles of scientific research and the practices of scientific methodology,
* generate research problems in information processing sciences,
* identify and describe the main research approaches and methods in information processing sciences, and choose the appropriate approach and method for a research problem,

* evaluate the methodological quality of a research publication, as well as
* 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:**
Blended teaching

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

**Target group:**
MSc students

**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering and Information Systems

**Recommended or required reading:**
Lecture slides and specified literature.

**Assessment methods and criteria:**
Accepted learning diary, active participation

**Grading:**
Pass or fail.

**Person responsible:**
Arto Lanamäki

## 817612S: Research and Development Project, 10 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tonja Molin-Juustila

**Opintokohteen kielet:** English

**ECTS Credits:**
10 ECTS credits / 267 hours of work.

**Language of instruction:**
English

**Timing:**
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course in the 2nd spring semester of the Master's studies.

**Learning outcomes:**
After completing the course, the student will be able to:
* demonstrate abilities to work as a professional expert on a challenging ICT project,
* acquire and apply professional expertise in the topic of the project,
* search up to date information on the topic of the project in order to build professional expertise on the topic and apply this in the project work,
* demonstrate skills to conduct an ICT project in a professional way,
* to act as independent professional member of an ICT project and have advanced professionalism in project work and management,
* collectively produce, monitor and update the plan of the project (project with fixed time and human resources),
* build professional working knowledge and skills focused in the topic 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,
* 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), as well as
* 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:**
The topics for the course project can be anything from the ICT field. 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:**
Blended teaching.

**Learning activities and teaching methods:**
Project work 260 h per student. Working hours reported during the project. Attendance at the starting lecture (4 h) is mandatory. Praparing a project portfolio in the end (3 h).

**Target group:**
MSc students.

**Prerequisites and co-requisites:**
The required prerequisite is that the learning ourcomes of the following courses and their predecessors are accomplished: Preparatory Course for MSc Studies (for students selected directly in the Master's Programme) or Fundamentals of Project Work (for students received BSc degree in Information Processing Science from University of Oulu).

**Recommended optional programme components:**
The expertise gained during this project course will be further elaborated during the Project Seminar course, which will immediately follow this course during period 4.

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

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

**Grading:**
Numerical scale 1-5 or fail.

**Person responsible:**
Tonja Molin-Juustila

**Working life cooperation:**
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. during the autumn semester of 2nd study year, until the end of period 1.

## 900017Y: Survival Finnish, 2 op

**Voimassaolo:** 01.08.1995 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Languages and Communication

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

| | | |
|---|---|---|
| ay900017Y | Survival Finnish Course (OPEN UNI) | 2.0 op |

**Proficiency level:**
A1.1

**Status:**
The course is intended for the international students in every faculty at the University of Oulu.

**Required proficiency level:**
No previous Finnish studies.

**ECTS Credits:**
2 ECTS cr
**Language of instruction:**
Finnish and English.
**Timing:**
-
**Learning outcomes:**
By the end of the course the student can understand and use some very common everyday expressions and phrases, and s/he can locate informational content in simple texts and messages. The student also knows the basic characteristics of Finnish language and Finnish communication styles.
**Contents:**
This is an introductory course which aims to help students to cope with the most common everyday situations in Finnish. During the course, students learn some useful everyday phrases, some general features of the vocabulary and grammar, and the main principles of pronunciation.

The topics and communicative situations covered in the course are: general information about the Finnish language, some politeness phrases (how to greet people, thank and apologize), introducing oneself, giving and asking for basic personal information, numbers, some time expressions (how to tell and ask the time, days of the week, time of day), food, drink and asking about prices.

The structures studied are: personal pronouns and their possessive forms, forming affirmative, negative and interrogative sentences, the conjugation of some verbs, the basics of the partitive singular and some local cases for answering the ‘where'-question.
**Mode of delivery:**
Contact teaching, on-line learning and independent work. There will be organized also one on-line group in each semester.
**Learning activities and teaching methods:**
Lessons 2 times a week (26 h, including the final exam) and guided self study (24 h).
**Target group:**
International degree and post-graduate degree students, exchange students and the staff members of the University.
**Prerequisites and co-requisites:**
-
**Recommended optional programme components:**
-
**Recommended or required reading:**
Will be provided during the course.
**Assessment methods and criteria:**
Regular and active participation in the weekly lessons (twice a week), homework assignments and written exam at the end of the course will be observed in assessment.
Read more about assessment criteria at the University of Oulu webpage.
**Grading:**
Grading scale is on a pass/fail basis.
**Person responsible:**
Arja Haapakoski
**Working life cooperation:**
-
**Other information:**
Sign-up in WebOodi or in Tuudo.

## 811602S: Advanced Software Quality and Security, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mika Mäntylä, Alireza Haghighatkhah

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 2nd autumn semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* understand and utilize software quality models,
* understand and utilize some software testing and security techniques, and understand their benefits and limitations, as well as
* apply software testing and security techniques in small scale projects.
**Contents:**
* Testing and quality techniques: Model-based testing, search-based testing, defect prediction, exploratory testing, combinatorial testing, static testing, static analyzers, virtualization, test automation,
* Security Attacks buffer overflows, command injection; Security testing: vulnerability scanning, intrusion detection.
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lecture 16 h, Exercises 24 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Professional Software Engineering Processes and Human Factors.
**Recommended or required reading:**
Lectures, Slides, Articles
**Assessment methods and criteria:**
Assignments, Exercises, Essays
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Alireza Haghighatkhah

## 811373A: Professional Software Engineering Processes and Human Factors, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Minna Isomursu

**Opintokohteen kielet:** English

**Leikkaavuudet:**

| | | |
|---|---|---|
| ay811373A | Professional Software Engineering Processes and Human Factors (OPEN UNI | 5.0 op |
| 815662S | Software Engineering Management, Measurement and Improvement | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 1st autumn semester of the Master's studies.
**Learning outcomes:**
After completing the student will be able to:
* recognize and describe software development processes models,
* evaluate and compare their applicability in different contexts,
* take human factors into account in planning and operating in professional software development,

* analyze their own strengths and improvement areas as software engineers to see opportunities for development, as well as
* participate in systematic efforts for improvement in software development organizations.

**Contents:**
Module 1: Software development process models. Theory and cases.
Module 2: Human factors in software development. Recognizing individual and team characteristics, and cultivating personal awareness and developement pathways.
Module 3: Software process improvement. Theory and cases.

**Mode of delivery:**
Introduction lecture (not mandatory), online assignments, 2-3 lectures of visiting professionals (not mandatory), seminar (online option)

**Learning activities and teaching methods:**
Individual and group activities.
All materials, assignments and group work will be done online.

**Target group:**
MSc students

**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Software Development, Maintenance and Operations.

**Recommended or required reading:**
Provided in Moodle.

**Assessment methods and criteria:**
Completing online assignments, active participation in peer feedback

**Grading:**
Pass or fail

**Person responsible:**
Minna Isomursu

**Working life cooperation:**
Visiting lectures of experienced software professionals (2-3)

## 811372A: Software Development, Maintenance and Operations, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mika Mäntylä

**Opintokohteen kielet:** English

**Leikkaavuudet:**

| | | |
|---|---|---|
| ay811372A | Software Development, Maintenance and Operations (OPEN UNI) | 5.0 op |
| 815312A | Software Production and Maintenance | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
English

**Timing:**
The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 1st autumn semester of the Master's studies.

**Learning outcomes:**
After completing the course, the student will able to:
* explain and utilize theories of software evolution,
* utilize the processes, techniques and tools for software deployment, and operations,
* utilize the processes, techniques and tools for software maintenance, as well as
* utilize the processes, techniques and tools to better understand and maintain large code bases.

**Contents:**
* Software Maintenance and Evolution
* Software Product Lines
* Software Maintenance and Evolution Models

* DevOps
* Reengineering
* Legacy Systems

**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Lectures (Video): 20 h, exercises / assignments 78 h, weekly study 42 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering and programming.
**Recommended or required reading:**
Videos, books, exercises
**Assessment methods and criteria:**
Exercises, assignements
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Mika Mäntylä

## 811603S: Software Platforms and Ecosystems, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Juustila, Antti Juhani

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 2nd autumn semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* define what are software platforms and ecosystems,
* understand how software platforms and ecosystems can be used for business,
* analyze the benefits and drawbacks of different platforms or ecosystems, as well as
* operate, use and make contributions to a particular software platform or ecosystem.

**Contents:**
* Introduction to software platforms and ecosystems
* Business and strategic aspects of platforms and ecosystems
* Development of software systems utilizing platforms or ecosystems
* Benefits and drawbacks of platforms or ecosystems - business and development views
* Case studies, practical project with a selected platform or ecosystem

**Mode of delivery:**
Lectures, exercises, group work, demonstrations, project work.
**Learning activities and teaching methods:**
Lectures  24 h, exercises or group work 24 h, independent study 52 h, assignments 48 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Advances Software Quality and Security
**Recommended or required reading:**
Announced in the beginning of the course

**Assessment methods and criteria:**
Exam, graded project work and reports, graded assignments.
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Antti Juustila

## 811604S: Software for Intelligent Systems and Artificial Intelligence (AI), 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Minna Isomursu

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course in the 2nd spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the students will be able to:
* reflect and critically assess the role of AI in software intensive services,
* reflect and discuss issues related to design of software intensive services using AI, as well as
* develop a project using the methods and theory learned throughout the course.
**Contents:**
The course consists of four main modules. These are:
* Introduction to the course
* Basics of AI in software intensive services
* AI project, the theme will be decided yearly
* theoretical reflective learnings
**Mode of delivery:**
Introduction lecture, online assignments, final seminar
**Learning activities and teaching methods:**
Individual online assignments, project work executed in groups, peer feedback in seminar
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Software Platforms and Ecosystems
**Recommended or required reading:**
Provided in Moodle
**Assessment methods and criteria:**
Online assignments,  project work with presentation
**Grading:**
Pass or fail
**Person responsible:**
Minna Isomursu

## 811605S: Software-Defined Products, Systems and Services, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tero Päivärinta

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course in the 2nd spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student is able to:
* describe the contemporary main concepts of the "software-defined everything" (SDx) perspective, such as software-defined networks, software-defined storage, software-defined data centers, software-defined computing,
* identify relevant software platforms and tools for developing solutions under the software-defined perspective (cf. the previous main concepts),
* present a service, system or product concept of her/his own interest transformed by the software-defined perspective, as well as
* develop and present a small-scale software project in a group to demonstrate a relevant aspect of the software-defined perspective.
**Contents:**
*Introduction to the main contemporary concepts of SDx ("Software-defined everything")
* Exemplary "software-defined" concepts to re-think products, systems, services
* Examples of typical software tools for implementing some of the related concepts
* Practical project on a selected software-defined concept (presentation and demonstrative implementation) with a selected development environment
**Mode of delivery:**
Lectures, seminar on student-defined concepts, project work, seminar on project presentations
**Learning activities and teaching methods:**
Lectures 12 h (on concepts; potentially guest lectures), Seminars 16 h (of student attendance), Independent study on the selected concept 24 h, project work 90 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Software Platforms and Ecosystems
**Recommended or required reading:**
Announced in the beginning of the course (timely articles and other materials)
**Assessment methods and criteria:**
Individual assignment, project work with presentation. (Depending on the number of students attending, the assignment on the conceptual idea for a new software-defined product, system or service can also be conducted as a part of the group assignment, according to the choice of the teacher.)
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Tero Päivärinta
**Working life cooperation:**
Possibly visiting lectures from companies or other organizations.
**Other information:**
The research groups related to the software-defined timpely projects and solutions can be invited to suggest relevant small-scale project topics for the students.

## 817615S: Creating Domain Value with Data, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pasi Karppinen

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English.
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 2nd spring semester of the Master's studies. The course is not implemented in Academic year 2020-2021.
**Learning outcomes:**
After the course the student will be able to:
* select appropriate data management technologies based on the needs of the domain,
* develop and implement organizational information management policies and processes,
* create an information architecture for an organization,
* integrate and prepare data captured from various sources for analytical use,
* identify appropriate data sources in a heterogeneous environment with multiple data types,
* select and use appropriate analytics methods,
* identify appropriate analytics methods for given tasks,
* use an analytics platform to perform basic analytics tasks,
* analyze data using advanced contemporary methods,
* select and apply advanced computational approaches to identify meaningful patterns and trends,
* build models to support decision-making activities, as well as
* design and implement architectures for organizational content management systems.
**Contents:**
Data management technologies based on the needs of the domain
* Organizational information management policies and processes
* Information architecture for an organization
* Heterogeneous environments with multiple data types
* Different analytics methods
* Analytics platforms
* Different computational approaches to identify meaningful patterns and trends
* Decision support models
* Architectures for organizational content management systems
**Mode of delivery:**
Face-to-face
**Learning activities and teaching methods:**
Lectures 20 h, independent study of the course literature, weekly tasks and scientific essay 110 h.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The recommended prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Societal and Individual Impacts of Information Systems.
**Recommended or required reading:**
Selected scientific articles and lecture material.
**Assessment methods and criteria:**
Active participation in lectures, weekly tasks, scientific essay.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Pasi Karppinen
**Working life cooperation:**
Possibly visiting lecturers from companies and other organizations.

## 812352A: Digitalisation and Innovation, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Piiastiina Tikka

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 1st spring semester of the Master's studies
**Learning outcomes:**
After completing the course, the student will be able to:
* identify and describe what is digitalisation and why it is happening,
* describe how information systems and digitalisation are connected,
* build an overview of organisational/enterprise information systems,
* describe the role of emerging technologies in the society,
* form an overview and describe how innovation takes place, particularly in IT, as well as
* identify opportunities and challenges of future technologies.
**Contents:**
* 1. What is digitalisation? What is digital transformation? Why digitalisation?
* 2. Information systems and digitalisation
* 3. Organisational information systems
* 4. The role of emerging technologies
* 5. The quest for disruptive Zero-to-One innovation
* 6. Core business values
* 7. Innovation strategies and innovation ecosystems
* 8. Opportunities and challenges of future technology
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures and interactive / hands-on exercises, course assignment (design task)
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Information Systems.
**Recommended or required reading:**
"Oinas-Kukkonen H. & Oinas-Kukkonen H.: Humanizing the Web: Change and Social Innovation. Palgrave Macmillan, Basingstoke, UK, 2013. Chapters 7-12.
Other reading matter, to be announced during the course."
**Assessment methods and criteria:**
Exam
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Harri Oinas-Kukkonen

## 817618S: Information Systems Strategy and Leadership, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Marianne Kinnula

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English

**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course at the 2nd spring semester of the Master's studies. The course is not implemented in Academic year 2020-2021.
**Learning outcomes:**
After completing the course, the student will be able to:
* describe how to create and implement long-term plans for designing, delivering, and using organizational information systems to achieve strategic domain goals and objectives,
* use different kinds of tools for managing this diverse and ambiguous environment;
* describe the differences between leading and managing and will be able to apply these to practice;
* describe strategic use of information systems in organizations;
* analyse a company situation in a continually changing, unpredictable and even hostile environment, as well as
* make well-grounded recommendations for the company courses of action.
**Contents:**
This course gives an overview of strategic planning for information systems as well as integration of IS strategies with business objectives. Particular attention will then be paid to the tools and frameworks that are available to assist managers in IS strategic analysis and help them understand the strategic impact of technological trends. Issues surrounding business ecosystems and interfirm collaboration will be examined from strategy perspective.
**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Lectures, assignments, independent work, 133h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The recommended prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Creating Domain Value with Data.
**Recommended or required reading:**
Research articles to be announced more specifcally during the course implementation
**Assessment methods and criteria:**
Participation in lectures/exercises, group work, course assignments
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Marianne Kinnula

## 812354A: Servitisation, Co-Creation and Business Development, 5 op

**Voimassaolo:** 01.01.2021 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Karin Väyrynen

**Opintokohteen kielet:** English

**Leikkaavuudet:**

| | | |
|---|---|---|
| ay812354A | Servitisation, Co-creation and Business Development (OPEN UNI) | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 1st autumn semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* develop software business in new businesses and established businesses,
* conduct market analysis to estimate the market potential for the business,
* apply the basics of financial calculation,
* understand differences in business models,

* understand the concept of servitization, as well as
* understand the concept of co-creation.

**Contents:**
The course takes the perspectives of both new businesses and established businesses and their development. Students develop a new software business idea and write a business plan based on the idea. In addition, students are introduced to the concepts of servitization and co-creation, with special focus on already established businesses.

**Mode of delivery:**
Lecture videos, exercises

**Learning activities and teaching methods:**
Lecture videos and independent reading of material 35 hours, exercises 14 hours, individual and team assignments 60 hours, (home) exam 24 hours

**Target group:**
MSc students

**Prerequisites and co-requisites:**
The recommended prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Digitalisation and Innovation

**Recommended or required reading:**
Provided in the digital learning space

**Assessment methods and criteria:**
The final grade is composed of the evaluations of the Business plan (teamwork), other individual/team assignments, and (home) exam.

**Grading:**
Numerical scale 1-5 or fail

**Person responsible:**
Karin Väyrynen

**Other information:**
The first lecture of the course is mandatory for all who want to participate in the course. It will be held on Monday, 26.10., from 14.15-16.00. You can join the lecture via Zoom here: https://oulu.zoom.us/j/67895947285. Please be on time.

Exercises are mandatory (via Zoom, link will be available in Moodle). Make sure you are enrolled to an exercise group, not only to the lectures.

IMPORTANT: Due to the University's requirement to offer the course as distant teaching only, only exercise group 1 (Tuesdays at 8.15-10.00) will be held.
All other lectures except lecture 1, and all lecture material and course information will be available in the Moodle environment of the course.
The Moodle workspace will be available starting from 24.10. here: https://moodle.oulu.fi/course/view.php?id=5204.

The first assignments have to be completed already BEFORE the first exercise (which is held on 3.11.), so make sure you attend the first lecture and complete the first assignments on time.

In the course, there are some assignments that have to be done on a specific day (no change in schedules possible!), so please reserve already now time in your calendars on the following days:
Monday, 16.11.: reserve 2 hours for a course assignment
Monday, 7.12.: reserve 4 hours for a course assignment

Other assignment deadlines will be available in the Moodle workspace upon the start of the course.

## 817619S: Societal and Individual Impacts of Information Systems, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Piiastiina Tikka

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 2nd autumn semester of the Master's studies. The course is not implemented in Academic year 2020-2021.
**Learning outcomes:**
After completing the course the student will be able to:
* understand and discuss the impact of the ICT in the society and changes that take place,
* understand how information systems transform ways of communication and interaction,
* form an overview of how human and societal traits and ICT co-exist, for example, through a series of paradoxes as well as
* gain basic understanding of behaviour change, behaviour analysis and digital intervention design as regards technology.
**Contents:**
1. Introduction to the course
2. Example: How ICT has changed the world
3. The promise
4. IS as a transformer
5. The paradoxes of change
6. Behavior analysis and behavior change
7. Digital intervention design
8. Ethical considerations

**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures and exercises, course reading, course assignment
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The recommended prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: User Experience (UX) Design and Management
**Recommended or required reading:**
Book: Oinas-Kukkonen H. & Oinas-Kukkonen H.: Humanizing the Web: Change and Social Innovation. Palgrave Macmillan, Basingstoke, UK, 2013, 248 pages (chapters 1-6).
Other materials (to be distributed during the course).
**Assessment methods and criteria:**
Course assignment (essay) or exam.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Piiastiina Tikka

## 812355A: User Experience (UX) Design and Management, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Arhippainen

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 1. It is recommended to complete the course in the 2nd autumn semester of the Master's studies. The course is not implemented in Academic year 2020-2021.
**Learning outcomes:**

After completing the course, the student will be able to:
* describe the significance and is able conceptualize user experience and human interaction with digital products, systems, and services,
* describe the central concepts, factors shaping and potential problems associated with user experience and human interaction with digital products, systems, and services,
* describe various interaction design, user experience design, service design and design thinking methods and use some of them in a practical design case of a novel digital product, system or service as well as
* describe various kinds of management, organizational, social, cultural and political aspects and challenges of user experience design.

**Contents:**
Central concepts (user experience, interaction design, design thinking, service design), human interaction with digital products, systems, and services, various user experience design, interaction design, service design and design thinking methods, management, organizational, social, cultural and political aspects and challenges of user experience design.

**Mode of delivery:**
Face-to-face teaching.

**Learning activities and teaching methods:**
Lectures, exercises, groupwork, individual assignments, seminar

**Target group:**
MSc students

**Prerequisites and co-requisites:**
The recommended prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Servitisation, Co-Creation and Business Development.

**Recommended or required reading:**
Scientific articles and books

**Assessment methods and criteria:**
During the course, the students will be carrying out a groupwork assignments and individual tasks. These will be assessed based on the learning outcomes of the course. The assessment criteria and the requirements will be explained in detail during the opening lecture of the course.

**Grading:**
Numerical scale 1-5 or fail

**Person responsible:**
Netta Iivari

**Working life cooperation:**
Guest lectures, customer assignments

## 811606S: Next Generation Software Engineering, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mika Mäntylä

**Opintokohteen kielet:** English

**Leikkaavuudet:**

| | | |
|---|---|---|
| 811600S | Emerging Trends in Software Engineering | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
English

**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course at the 1st spring semester of the Master's studies.

**Learning outcomes:**
After passing the course, a student will be able to:
* descreibe the new trends in software engineering,
* perform computer supported trend mining to discover new trends of any given topic, as well as
* critically think and write about the trends.

**Contents:**
* Software engineering trends (varies)
* Automated trend mining from online databases
* Writing, arguing and discussing about the trends
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures 24 h, exercises 18 h, essays 30 h, project 30 h, independent study 31 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Software Engineering Research.
**Recommended or required reading:**
Articles, lectures, videos
**Assessment methods and criteria:**
Active lecture participation, exercises, assignments, essays
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Mika Mäntylä

## 815663S: Software Engineering Research, 5 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Oivo, Markku Tapani

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work.
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course in the 1st spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will able to:
* describe the current research areas in software engineering and the most important software engineering research methods,
* describe academic research and publishing in software engineering,
* critically analyse scientific articles from the viewpoint of the content and research methods used in the article,
* present academic research, as well as
* actively participate in an academic discussion of research papers and research results.
**Contents:**
State of the art research methods and topics in software engineering.
**Mode of delivery:**
Face-to-face teaching.
**Learning activities and teaching methods:**
Lectures and seminars 28 h, exercises / assignments 78 h, weekly study 42 h.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering or Information Systems.
**Recommended or required reading:**

**Assessment methods and criteria:**

Active participation in lectures and attendance. Final grade is composed of attendance, assignments and term paper. No remote participation or distance learning.
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Markku Oivo

## 812650S: Advanced Topics in Digital Cultures and Design, 5 op

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Dorina Rajanen

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 1st spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* describe state-of-the-art research results related to digital cultures and design;
* understand the strengths and limitations of various methods and frameworks used;
* show competence in critiquing research articles published in some of the leading academic journals and conference proceedings;
* show competence in critical thinking, and analysis and synthesis of academic sources;
* show competence in verbally presenting arguments in an academic fashion;
* write a literature review on a relevant research topic;
* acquire knowledge and critically read relevant research articles on digital culture and design related research topics; as well as
* describe ethical aspects involved with work related to digital cultures and design.
**Contents:**
The content of the course will change with time. The initial set of current themes include: 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 such as: 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 20 h, assignments 107 h, seminars 6 h.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering and Information Systems
**Recommended optional programme components:**

**Recommended or required reading:**
Selected scientific articles.
**Assessment methods and criteria:**
Assignments
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Mikko Rajanen

## 812671S: User Experience (UX) and Usability Evaluation, 5 op

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Dorina Rajanen

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work.
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course in the 1st spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* design and follow through a UX/usability evaluation process,
* design test scenarios and tasks,
* select participants,
* plan and follow through the evaluation in laboratory or in the field, as well as
* analyse and report the findings from the evaluations.
**Contents:**
Basic terms and types of UX and usability testing, usability and UX tests process, usability and UX test tasks and scenarios, test subjects, following through a usability and UX tests, analysing usability and UX test material, reporting the findings from usability and UX tests.
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures 24h, assignment tutoring 13h, assignment 90h, seminar 7h.
**Target group:**
MSc students

**Prerequisites and co-requisites:**
The recommended prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Servitisation, Co-Creation and Business Development.
**Recommended optional programme components:**

**Recommended or required reading:**
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 or fail
**Person responsible:**
Mikko Rajanen
**Working life cooperation:**
Students learn how to collaborate with real customers
**Other information:**

## 812651S: ICT and Behaviour Change, 5 op

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Piiastiina Tikka

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course at the 1st spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* grasp the core theories of behaviour change and how they are/can be applied in goal-oriented behaviour change,
* identify and discuss ethical concerns inherent in behaviour change and persuasive systems, and
* identify and discuss the possible negative effects of ICT use not only as regards persuasive systems, but also with social media and other use.
**Contents:**
The focus of the course is role of ICT in supporting people with their endeavours to change their habits or lifestyles. The course introduces the main theories and models regarding behaviour change in order to provide students with a solid base for understanding how behaviour change can also work through ICT. The course also introduces some of the more problematic topics in ICT and behaviour, such as the dark side of ICT use and ethics of persuasion.
The course aims at providing existing knowledge and theoretical starting points to the development and use of persuasive systems. With such base, the student will be able to review the field from a broad perspective with the view to applying appropriate theories and approaches when analysing or developing persuasive systems.
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures 14 h, seminars 20 h, individual and group assignments 100 h; or in self-study mode opening lecture 2 h, assignments 132 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The suggested prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Persuasive Systems Design.
**Recommended optional programme components:**
The MSc courses "Persuasive Systems Design" and "Emerging Technologies and Issues" would be helpful, but is not required.
**Recommended or required reading:**
Research articles to be announced more specifcally during the course implementation
**Assessment methods and criteria:**
Course assignment
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Piiastiina Tikka
**Working life cooperation:**
-

## 811607S: Persuasive Systems Design, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Oinas-Kukkonen, Harri Ilmari

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 1st spring semester of the Master's studies.
**Learning outcomes:**
After passing the course a student will be able to:
* analyze methods and techniques employed by persuasive systems,
* apply such methods in an ethical manner as design guidelines for developing persuasive ICT solutions, as well as
* apply gamification as persuasive design principles for serious games and other similar solutions.
**Contents:**
Attitudinal theories from social psychology have been quite extensively applied to the study of user intentions and behaviour. These theories have been developed mostly for predicting user acceptance of information technology rather than for providing systematic analysis and design methods for developing software solutions that aim at attitude or behaviour change. At the same time a growing number of information technology systems and services are being developed for these purposes.
This course will focus on persuasive technology. It will address the process of designing and evaluating persuasive systems, the types of content and software functionality in such systems, the underlying assumptions behind these, methods for analysing the persuasion context, and principles for persuasive system design. The course also looks into the methods and techniques of gamifying persuasive content.
The course is primarily geared towards analysis and design tasks using the Persuasive Systems Design model as the main approach. Gamification forms another segment of the course, introducing topics in the role of games and game-like experiences in supporting persuasion.
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures 20h, readings before lectures 21h, personal reflective exercises 21h, supervisory meetings 14h, project assignment 48h, other course related activity 10h.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering and Information Systems
**Recommended optional programme components:**
This course offers good groundwork for ICT and Behaviour Change course, but is not compulsory.
**Recommended or required reading:**
Research articles to be announced more specifcally during the course implementation
**Assessment methods and criteria:**
Participation in lectures, personal reflection reports, course assignments.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Harri Oinas-Kukkonen

## 812649S: Advanced Research Methods, 5 op

**Voimassaolo:** 01.08.2016 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Faculty of Information Technology and Electrical Engineering

**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:**
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 2nd spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* describe the background, philosophical assumptions and guiding principles of quantitative, qualitative and design science research, their role in information systems and software engineering research and the variety involved in them;
* evaluate the strengths and weaknesses of the research approaches and methods in relation to her or his research topic as well as select the suitable approach and methods;
* use more advanced data analysis methods;
* prepare a research plan for a research project, including formulating research problems, specifying research designs and choosing appropriate data collection and analysis methods for solving the problems;
* describe state-of-the-art ways of reporting the results;
* evaluate the methodological quality of her or his research and research publications more generally; as well as
* search more information on research methods from scientific literature as well as to adapt and refine methods for her or his research problems and interests.
**Contents:**
Introduction to qualitative, quantitative and design science research in information systems and software engineering, their scientific background,
philosophical assumptions and guiding principles, variety involved in them, relationships between the research approaches and associated frameworks, methods, processes and practices, advanced data analysis methods, reporting and evaluating research within the approaches.
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures 16 h, exercises 12 h, seminar 18 h, individual and group assignments 100 h
**Target group:**
MSc students, PhD students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses are accomplished: Research Methods. In addition, the student must have a preliminary thesis topic.
**Recommended optional programme components:**
Recommended to take before Master's thesis.
**Recommended or required reading:**
Selected scientific articles or research method books.
**Assessment methods and criteria:**
Assignments
**Grading:**
Pass or fail
**Person responsible:**
Netta Iivari

## 811330A: Project management, 5 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Kari Liukkunen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English, interaction with a project team may be in Finnish
**Timing:**
The course is held in the spring semester, during periods 3 - 4. Optional course. It is recommended to complete the course in the 1st spring semester of the Master's studies.

**Learning outcomes:**
After completing the course, the student will be able to:
* master the principles of a time management and priorisation needed in the project,
* gather information on the progress of a project and based on it, make project related decisions,
* apply theory on project management in practice,
* recognise risks of software projects and prepare for them,
* work as a project manager, as well as
* communicate with stakeholders by using both written and spoken language.

**Contents:**
Lectures give student tools to lead a software project focusingon leadership skills and common problem situations in project work.

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Lectures 10 h and indpendent work 123 h

**Target group:**
MSc students

**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree and has knowledge how to participate in a project as a team member.

**Assessment methods and criteria:**
Active participation in management training, succesfully leading project and drawing up the project plan and the learning diary.

**Grading:**
Numerical scale 1-5 or fail

**Person responsible:**
Kari Liukkunen

**Working life cooperation:**
Project topics are usually connected to companies

## 816630S: Scientific paper writing, 1 - 3 op

**Voimassaolo:** 01.08.2008 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Henrik Hedberg

**Opintokohteen kielet:** English

**ECTS Credits:**
2 - 5 ECTS credits / 53 - 133 hours of work

**Language of instruction:**
Finnish or English

**Timing:**
Timing of the course is free. Student will search for the paper topic and supervisor on his/her own.

**Learning outcomes:**
After completing the course, the student will be able to:
* author a scientific paper under supervision.

**Contents:**
The course supports other research courses, where an opportunity to writing a scientific research article is given.

**Mode of delivery:**
Self study

**Learning activities and teaching methods:**
The course is realized under a supervision of a chosen supervisor, whose permission must be obtained before starting the course.

**Target group:**
MSc students

**Prerequisites and co-requisites:**
The recommended prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Research Methods

**Recommended optional programme components:**
A scientic publication may be produced based on the Master's Thesis.
**Assessment methods and criteria:**
A student or a student team may obtain credits from this course when the paper is accepted by the supervisor for a submission to a conference or journal. The supervisor's statement is delivered to the responsible person, who gives the cource credits.
**Grading:**
Pass or fail
**Person responsible:**
Programme Director
**Other information:**
The numbers of credits are based on the contribution of the author, quality of the paper and the demand level of the publication forum.

## 811610S: Special Course in Information Processing Science 1, 5 - 10 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Netta Iivari

**Opintokohteen kielet:** English

**ECTS Credits:**
5 - 10 ECTS credits / 133 - 267 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 3. In addition, there may be other implementations around the year, including summer.
**Learning outcomes:**
The learning outcomes of the course vary depending on the content.
**Contents:**
Varying contents related to the Information Processing Science.
**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Varies depending on the content.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering or Information Systems
**Assessment methods and criteria:**
Varies depending on content.
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Programme Director and nominated persons for specific implementations
**Working life cooperation:**
May be organised together with companies or professionals.
**Other information:**
One course implementation is 5 ECTS credits. A student may take at most two different course implementatios and receive 10 ECTS credits.

## 814601S: Work Experience in ICT responsibilities, 5 op

**Voimassaolo:** 01.08.2010 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Practical training

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tonja Molin-Juustila

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
3-5 ECTS credits / 2–4 months of full time work
**Language of instruction:**
Finnish or English.
**Timing:**
Timing of this course is free. Recommended to take as a summer course. The course is also suitable for the supported work placement studies. In that case, it is recommended to search for the work placement and apply for the support already at the turn of the year.
**Learning outcomes:**
After completing the course, the student will be able to:
* master certain part of professional ICT work in enterprises or public organisations,
* analyse and reflect on the work experience with Information Processing Science studies, as well as
* write an informative report on his/her work experience.
**Contents:**
Working from two to four months in professional ICT responsibilities that require university level studies.
**Mode of delivery:**
Self study
**Learning activities and teaching methods:**
The student is responsible for making the needed arrangements for the internship: search for the work placement, negotiate job contract, prepare the support application when needed, follow the agreed labor agreement, work within the agreed responsibilities as well as study independently the needed professional skills and knowledge. In addition, the student documents his/her internship according to the course requirements weekly.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
Information Processing Science or related studies, which enable their practical application in the context of professional ICT responsibilities.
**Recommended or required reading:**
Studies and selected course materials related to the internship in professional ICT responsibilities.
**Assessment methods and criteria:**
Working in professional ICT responsibilities from two to four months. Work experience can be realized in several periods, which all are processed as independent internship periods. The work experience is proved by delivering a signed letter of reference from the employer(s). The letter of reference contains details of the internship period and the student's primary duties and responsibilities. After the internship period, experiences are reported as soon as possible. An internship report consists of description of realized work and analysis of learning outcomes in relation to the studies taken in Information Processing Science. 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 as well. Based on the internship period, student will gain 3-5 ECTS credits (2 months = 3, 3 months = 4, 4 months = 5).
In addition to above, student may also document his/her personal plan and learning goals for the internship period as well as report weekly implementation status of those plans and goals. In this case, 5 ECTS credits will be gained already from 2 months' internship period. For applying the financial support, this documentation is mandatory.
**Grading:**
Pass or fail
**Person responsible:**
Tonja Molin-Juustila
**Working life cooperation:**
Working on professional ICT responsibilities.
**Other information:**
Documenting guidelines and templates are available in the course materials. Before the internship starts, the support application must be recorded in the university systems with the copy of the internship agreement. The letter of reference from the employer(s) will be recorded together with the credits.

## 902165Y: English Communication for Information Processing, Oral Skills, 3 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Languages and Communication

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**Leikkaavuudet:**

902162Y-02 English Communication for Information Processing, Oral Skills 3.0 op

**Proficiency level:**
B2/C1 on the Common European Framework of Reference scale
**Status:**
This course is mandatory for students of Information Processing Science who will have English as their foreign language in their B.Sc. degree. The course is mandatory for Information Processing Sciences B.Sc. degree students who begin their studies in Autumn 2017.
**Required proficiency level:**
The students taking this course must have had English as an A1 or A2 language or equivalent English skills.
**ECTS Credits:**
3 ECTS credits / 80 hours of work
**Language of instruction:**
English
**Timing:**
Information Processing Science, 1st year Spring (periods 3 & 4)

**Learning outcomes:**
By the end of the course you are expected to demonstrate the ability to:
--**use appropriate strategies and techniques for communicating effectively** in English in scientific and professional contexts in your own field
--**participate actively in team-building exercises and group work** in the classroom and in homework assignments
--**identify and practice effective interviewing skills and negotiation skills**
--**prepare and present scientific subjects from your own field of study**, using appropriate field-related vocabulary, both independently and in groups
--**recognize the stages of effective negotiations and meetings**
--**identify the phases of project management** and practice these.
**Contents:**
In the classroom, you will practice the skills of listening, speaking, and presenting topics in your own field. The emphasis is on working in pairs and small groups. In addition to a group project, you will complete independent homework assignments, including a blog, to support the classroom learning. There are 2 presentations to be given by groups.
**Mode of delivery:**
Contact teaching, group work and independent work
**Learning activities and teaching methods:**
There will be 26 hours of guided teaching events in the classroom and 48 hours of independent work, which includes both individual and group work.
Individual work: weekly readings, a course blog and preparation for a job interview
Group work: Group project and preparation of 2 presentations
**Target group:**
1st year students of Information Processing Science

**Prerequisites and co-requisites:**
Co-requisite:
English Communication for Information Processing-A (902164Y), to be taken concurrently during the same term
**Recommended optional programme components:**
-
**Recommended or required reading:**
-

**Assessment methods and criteria:**
This course utilises *continuous assessment* and requires regular attendance and active participation. The assessment criteria are based on the learning outcomes.
Homework tasks include both independent and group work, for example:
-- Independent learning methods: reading + blog work, 18 hours
-- Group project + preparing presentations: 30 hours

-- Preparing job interview: 6 hours.
Read more about assessment criteria at the University of Oulu webpage.
**Grading:**
Pass / fail
**Person responsible:**
Karen Niskanen and Satu Rusko

## 902164Y: English Communication for Information Processing, Reading for Academic Purposes, 2 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Languages and Communication

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**Leikkaavuudet:**

902162Y-01 English Communication for Information Processing, Reading 2.0 op

**Proficiency level:**
B2/C1 on the Common European Framework of Reference scale.
**Status:**
This course is mandatory for students who choose English as their foreign language in the following B.Sc. degree programme:
**Faculty of Information Technology and Electrical Engineering**

- Department of Information Processing Science

Exemption from ECIP-A RAP (2op/2ECTS) will be granted to students with *laudatur* or *eximia cum laude approbatur* grades from the “long language” matriculation examination. These students should sign up for an ECIP-B (Scientific Communication 3 op/ECTS) group only.
Please consult your faculty’s 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 / 52 hours of work
**Language of instruction:**
English
**Timing:**
Information Processing Science:
1st year Spring term (periods 3 and 4) from Spring 2020 onward.

**Learning outcomes:**
In ECIP-A, you will learn to read more extensive academic - general or discipline-specific - text with increased confidence and at sufficient speed and to process it critically. By the end of the course, you are expected to
--have acquired effective vocabulary-learning techniques
--be able to distinguish parts of words to infer meanings
--be able to utilise your knowledge of text structure and cohesion markers to understand academic texts
--be able to extract information and learn content from English readings in scientific and professional contexts and to summarise content in oral and written form.
**Contents:**
The course will focus on reading strategies; these include recognising how texts are organised, 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 and independent study
**Learning activities and teaching methods:**

There are 26 hours of guided teaching events and 28 hours of independent study, either individually or in a group. Homework tasks include vocabulary study and written work. A more detailed course description and list of homework tasks will be provided by the teacher.
**Target group:**
ECIP-A and ECIP-B are both offered during the Spring of the 1st year from Spring 2020 onward.

**Prerequisites and co-requisites:**
Students are also required to take the co-requisite course English Communication for Information Processing B (902165Y), which is offered concurrently during the same term.
**Recommended optional programme components:**
-
**Recommended or required reading:**
Course materials will be provided in electronic form or will be accessible from the university library.
**Assessment methods and criteria:**
Student work is monitored by continuous assessment, and students are required to participate regularly and actively in all contact teaching provided. During the course, there will be three tests on material covered so far, reading tasks and written work (e.g. a critique and a blog). ECIP A coursework is designed to coordinate with the ECIP-B coursework. The assessment of the course is based on the learning outcomes listed above.
Read more about assessment criteria at the University of Oulu webpage.
**Grading:**
Pass/Fail
**Person responsible:**
Satu Rusko and Karen Niskanen
**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. Please contact your own faculty for information.

## 030005P: Information Skills, 1 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Faculty of Technology

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Ursula Heinikoski

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

| | | |
|---|---|---|
| 030004P | Introduction to Information Retrieval | 0.0 op |

**ECTS Credits:**
1 ECTS credit / 27 hours of work
**Language of instruction:**
Finnish
**Timing:**
Architecture 3. spring semester, period III;
biochemistry 3. autumn semester;
biology 3. autumn semester, period I;
chemistry 3. autumn semester, period I;
civil engineering 2. spring semester, period IV;
computer science and engineering 2. spring semester, period IV;
electronics and communications engineering 3. spring semester;
geosciences 2. spring semester, period IV;
geography 3. semester, periods I and III;
industrial engineering and management 3. year;
information processing sciences 1. or 3. year;
mathematics and physics 1. spring semester, period III;
mechanical engineering 3. year;
mining engineering and mineral processing 3. year;

process and environmental engineering 2. year, period II;
Master's degree students in industrial engineering and management 1st year.
**Learning outcomes:**
Upon completion of the course, the students:
- can search scientific information,
- can use the most important databases of their discipline,
- know how to evaluate search results and information sources,
- can use the reference management tool.
**Contents:**
Scientific information retrieval process, the most important databases and publication channels of the discipline, evaluation of the reliability of information sources and reference management tool.
**Mode of delivery:**
Blended teaching: classroom training, web-based learning material and exercises, a group assignment.
**Learning activities and teaching methods:**
Training sessions 8 h, group working 7 h, self-study 12 h
**Target group:**
Compulsory for all bachelor degree students of Faculty of information technology and electrical engineering, Faculty of Technology and Faculty of science. Compulsory also for those Master's degree students in Industrial Engineering and Management who have no earlier studies in the information skills. Optional for the students of biochemistry.
**Recommended optional programme components:**
In biochemistry the course is completed as a part of 740376A Bachelor's Thesis.
**Recommended or required reading:**
Web learning material Tieteellisen tiedonhankinnan opas
**Assessment methods and criteria:**
Passing the course requires participation in the training sessions and successful completion of the course assignments.
**Grading:**
pass/fail
**Person responsible:**
Ursula Heinikoski

## 900105Y: Launch your career through communication, 5 op

**Voimassaolo:** 01.01.2017 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Languages and Communication

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**Proficiency level:**
This course is offered only in Finnish.

## 810020Y: Orientation Studies, 2 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** General Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Helena Tokkonen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
2 ECTS credits / 53 hours of work.
**Language of instruction:**
Finnish
**Timing:**

The course is held in the autumn semester, during periods 1 and 2. The course is taken at the beginning of the studies. Tutor teaching activity continues throughout the whole first study year.

**Learning outcomes:**

After completing the course, the student will be able to:
* recognize from the viewpoint of his/her university studies the actions and services of the most important units, organizations and societies and his/her action possibilities in them,
* recognize 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,
* discuss on the purpose of his/her studies and the upcoming study path,
* create and present his/her own Personal Study Plan (PSP),
* tell about his/her university and exploit its services, as well as
* be interaction with staff members of Information Processing Science degree programme and other students as well as feels like beign part of the student group.

**Contents:**

1. Common events and lectures, 2. Independent study, 3. Small group activities (student tutoring), 4. PSP process, 5. Library and Oula database introduction, 6. Teacher tutoring.

**Mode of delivery:**

Blended teaching.

**Learning activities and teaching methods:**

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

**Target group:**

BSc students majoring 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. Conducting independent assignments.

**Grading:**

Pass or fail.

**Person responsible:**

Leena Ventä-Olkkonen

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

**Voimassaolo:** 01.08.2014 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Languages and Communication

**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 |

**Proficiency level:**
Please look course description from this course: 901048Y.

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

**Voimassaolo:** 01.08.2014 -

**Opiskelumuoto:** Language and Communication Studies

**Laji:** Course

**Vastuuyksikkö:** Languages and Communication

**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 |

**Proficiency level:**
This course is only for Finnish speaking students with CEFR-level A2 in Swedish language. University of Oulu, Languages and Communication unit don’t offer Beginners courses in Swedish.

## 811102P: Devices and Data Networks, 5 op

**Voimassaolo:** 01.01.2019 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Juustila, Antti Juhani

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

| | | |
|---|---|---|
| ay811102P | Devices and Data Networks (OPEN UNI) | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 1st autumn semester of the Bachelor's studies
**Learning outcomes:**
After completing the course, the student will be able to:
* explain the basic structure and the development history of a microprocessor
* identify the core features of microprocessors (word size, clock frequency, power consumption, level of integration, RISC/CISC) and based on these, choose a suitable processor regarding the problem at hand
* describe the different representations of data (binary, hexadecial, octal) as well as data persistence and presentation formats within a computer as well as in data transmission through networks
* describe the most important peripheral devices, data buses and interfaces (memory, I/O, USB, I2C, SPI)
* explain the principles of using stack and heap memories from the programmer's perspective
* explain the central properties and history of internet and important internet protocols (such as TCP, UDP, HTTP, TLS/SSL, XMPP, DHCP) as well as the layered architecture of protocols
* describe the implications of data networks, such as delays, packet loss and capacity, and understand the effects of these on developing services and applications relying on networks.
* explain the particular features of wireless networks
* identify the basic techniques of utilizing networks when developing services and applications, using some programming language
**Contents:**
Basic structure and development history of microprocessors. Core features of microprocessors (word size, clock frequency, power consumption, level of integration, RISC/CISC). Different representations of data (binary, hexadecial, octal), data persistence and presentation formats in computers and networks. Peripheral devices, data

buses and interfaces (memory, I/O, USB, I2C, SPI). Stack and heap memories. Properties and history of internet and internet protocols, layered architecture of protocols. Impact of data network properties on developing services and applications. Wireless networks. Programming networked applications and services.

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Lectures, (20 h), independent studying (30 h), exercises (20 h), demonstrations (20 h), essay (20 h), other active teaching methods and group work (20 h).

**Target group:**
BSc students

**Recommended optional programme components:**

**Recommended or required reading:**
Lecture material, demonstrations, exercise material and other material and literature announced in the course.

**Assessment methods and criteria:**
Exam (in learning environment), personal portfolio, essay, continuous evaluation.

**Grading:**
Numerical scale 1-5 or fail

**Person responsible:**
Antti Juustila

## 811168P: Information Security, 5 op

**Voimassaolo:** 01.08.2010 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tero Päivärinta

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

| | | |
|---|---|---|
| ay811168P | Information Security (OPEN UNI) | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work.

**Language of instruction:**
Finnish

**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course in the 1st spring semester of the Bachelor's studies.

**Learning outcomes:**
After completing the course, the student will be able able to:
* define essential information security concepts and components of information systems security,
* recognize the common types of security threats, and their managerial and technical protection mechanisms,
* describe the tasks and responsibilities of information security professionals,
* explain the different phases of secure systems development/acquisition,
* recognize the fundamental characteristics of risk management and evaluate information security risks,
* recognize basics of technical information security methods and cryptography, as well as
* explain areas of behavioral information security research and their practical implications.

**Contents:**
* Basic concepts of information security
* Information security threats, vulnerabilities, and risks
* Legal issues and information security frameworks
* Risk management
* Cryptography
* Information security technologies
* Behavioral information security research

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**

Lectures and related quizzes or final exam 26 h, weekly assignments and scientific essay 107 h
**Target group:**
BSc students.
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses are accomplished: Introduction to Information Processing Science as well as Devices and Data Network
**Recommended optional programme components:**

**Recommended or required reading:**
Lecture materials, selected articles, and book: Whitman & Mattord (2015). Principles of information security.
**Assessment methods and criteria:**
Weekly assignments. Group or individual assignment.
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Tero Päivärinta

## 810136P: Introduction to Information Processing Sciences, 5 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Henrik Hedberg

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

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

**ECTS Credits:**
5 ECTS credits / 133 hours of work.
**Language of instruction:**
Finnish
**Timing:**
The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 1st autumn semester of the Bachelor's studies. Another implementation, targeted especially for Open University and minor students, is held in the spring semester, during period 4.
**Learning outcomes:**
After passing the course, a student will be able to:
* describe the disciplines of Information Processing Science,
* explain the essential Information Processing Science concepts,
* name historically significant and current research topics in Information Processing Science,
* identify the characteristics and requirements of work tasks in the field of Information Processing,
* describe the principles of responsible conduct of research and professional ethics in Information Processing Science,
* retrieve, analyse, contest and classify information related to those, as well as
* discuss and report in written form on those using one reference convention of the scientific discipline.
**Contents:**
The course consists of lectures on disciplines, essential concepts, historically significant and current research, practical work life as well as responsible conduct of research and professional ethics in Information Processing Science. In addition, the student will familiarize with scientific work skills by listening, discussing, reading, thinking critically and creatively, retrieving data, classifying and presenting in written form.
**Mode of delivery:**
Distance or blended teaching
**Learning activities and teaching methods:**
Distance and potentially blended studies 133 h
**Target group:**
BSc students
**Recommended optional programme components:**

**Recommended or required reading:**
Digital study material, material searched by students themselves.

**Assessment methods and criteria:**
Exercise tasks.

**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Henrik Hedberg
**Working life cooperation:**
Cooperation with persons studied Information Processing Science and currently working.

## 811174P: Introduction to Software Business, 5 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**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 / 133 hours of work.
**Language of instruction:**
Finnish
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 1st spring semester of the Bachelor's studies.

**Learning outcomes:**
After completing the course, a student will be able to:
* 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; as well as
* describe legal issues related to 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.
**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Blended teaching 100 h, home essay 30 h
**Target group:**
BSc students.
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses are accomplished: Introduction to Information Processing Science
**Recommended optional programme components:**
-
**Recommended or required reading:**
Course material and related literature.
**Assessment methods and criteria:**
Assignments, take home examination.
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Marianne Kinnula

## 811319A: Data Modeling and Design, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Iisakka, Juha Veikko

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course in the 2nd spring semester of the Bachelor's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
• compare traditional relational database to modern distributed databases, as well consider the influence of CAP-theorem to distributed databases,
• identify features affecting the quality of non relational databases and choose appropriate implementation of non relational database for use,
• explain data persistency concepts and can apply database transaction management principles while using databse systems, as well as
• describe (typical) contemporary database solutions and their role in large-scale software systems (such as ERP).
**Contents:**
Modern database solutions and the use of them as well transactions, concurrency and recovery.
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures 4 h, Exercises 12 h, Study groups 8 h (+preparation 32 h), online assignments 36 h, litterature reviews 40 h
**Target group:**
BSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Software Quality and Testing, Databases
**Recommended or required reading:**
Will be anounced in the course. Scientific articles.
**Assessment methods and criteria:**
Continuous evaluation.
Study groups, online assignments, litterature reviews
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Juha Iisakka

## 811103P: Introduction to Software Engineering, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Oivo, Markku Tapani

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

| | | |
|---|---|---|
| ay811103P | Introduction to Software Engineering (OPEN UNI) | 5.0 op |

811346A Software Engineering 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course at the 1st autumn semester of the Bachelor's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* describe the principles, define the key concepts and use professional terminology of software engineering,
* describe software engineering as a professional practice and a field of industry,
* describe and work following professional practices that are important for software engineers,
* describe contemporary software processes and choose appropriate ones for specific situations,
* describe and apply valid problem identification and structuring methods in software engineering,
* identify and apply some contemporary software engineering models, methods and tools, as well as
* describe the necessity of continuing learning and professional development.
**Contents:**
* Principles of professional software development
* Software processes
* Agile software development
* Requirements engineering
* System modelling
* Architectural design
* Design and implementation
* Software testing
* Software evolution
**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Lectures, group exercises, independent work, 133h
**Target group:**
BSc students
**Prerequisites and co-requisites:**
The suggested prerequisite is that the learning outcomes of the following courses are accomplished: Introduction to Information Processing Science
**Recommended or required reading:**
Sommerville, Ian (2016). Software Engineering, 10th Edition
**Assessment methods and criteria:**
Moodle exercises and essays
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Markku Oivo
**Working life cooperation:**
Guest lectures and /or company visits

## 811391A: Requirements Engineering, 5 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Markus Kelanti

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay811391A Requirements Engineering (OPEN UNI) 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work.

**Language of instruction:**
Finnish
**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course in the 1st spring semester of the Bachelor's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* apply requirements engineering skills and techniques individually and in teams, and understands the requirements fundamentals,
* choose and apply some of the requirements elicitation techniques,
* choose and apply some of requirements specification and documentation techniques, as well as
* apply appropriate requirements validation techniques, as well as learn new requirements engineering methods and techniques.
**Contents:**
* Requirements traceability
* Different stakeholder viewpoints and requirement categories
* Requirements change
* Problem structuring methods
* Requirements engineering skills and techniques in iterative development environment
* Requirements identification, elicitation, specification and documentation techniques
* Requirements prioritization and validation techniques
**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Lectures and exercises 32h; independent work, group project and individual work 101h. Alternatively, independend study and book exam 133h.
**Target group:**
B.Sc. students.
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Introduction to Software Engineering
**Recommended optional programme components:**

**Recommended or required reading:**
Wiegers, Karl & Beatty, Joy (2013). Software Requirements, 3rd Edition.
**Assessment methods and criteria:**
Active participation (lectures, weekly assignments, group project and individual project), or alternatively book exam
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Markus Kelanti
**Working life cooperation:**
Guest lectures

## 815345A: Software Architectures, 5 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pertti Seppänen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course at the 2nd spring semester of the Bachelor's studies.

**Learning outcomes:**
After passing the course, the student is able to:
* describe the concepts and techniques of the software architecture design – especially in case of object-oriented design,
* describe typical architecture solutions of main-stream modern software solutions – for instance apps of smart devices and server-based systems,
* identify and analyze the pros and cons of different software architectures from the viewpoints of software design & implementation, software execution, software quality and software maintainability,
* use UML modeling techniques to describe different perspectives of a software architecture,
* create different optional architectural solutions for a software based on its functional and non-functional requirements and evaluate the applicability of the optional architectures to the problem in question, as well as
* describe the role of architectural design in agile and iterative software development processes.
**Contents:**
The fundamentals of software architectures. Documenting software architectures. Components and interfaces, Software dependencies. Design patterns. Architectural styles. Evaluation methods of software architectures. Agile and iterative software development processes and software archteture desing.
**Mode of delivery:**
Face-to-face teaching.
**Learning activities and teaching methods:**
Lectures 24 h, exercises 20 h, exercise work as group work 90 h.
**Target group:**
BSc students.
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Data Modeling and Design
**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 Third Edition. Addison-Wesley 2013; Agile Software Architecture 1st Edition Aligning Agile Processes and Software Architectures (2013) to an applicable extend.
**Assessment methods and criteria:**
The course is passed by participating in the course assignments as well as by evaluation of the exercise work.
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Pertti Seppänen
**Working life cooperation:**
Guest lectures

## 811301A: Software Modeling and Design, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tero Päivärinta

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

812342A Object Oriented Analysis and Design 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 2nd autumn semester of the Bachelor's studies.
**Learning outcomes:**

After completing the course, the student will be able to:
* apply possibilities of UML-language family to describe different views of software development,
* produce detailed descriptions using static and dynamic modelling and code from design models,
* describe principles of object-orientation, reverse engineering and general principles and concepts of software design (such as abstraction, modularization, cohesion, connectedness), as well as
* describe role of best practices in software modelling and design.

**Contents:**
UML notation and methodology. Some of UML -diagrams (at least class, sequence and static diagrams). Principles of object-orientation and quality aspects of it. Design best practices.
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures 32 h, exercises 32 h, self study 66 h
**Target group:**
BSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses are accomplished: Requirements Engineering, Programming 2.
**Recommended or required reading:**
Advanced UML literature chosen by the teacher as well as course material and related literature
**Assessment methods and criteria:**
Examination and week exams.
Weekly every exercises will be evaluated. Moreover there will an examination of topics not covered in exercises. All must be passed.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Tero Päivärinta

## 811306A: Software Quality and Testing, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mika Mäntylä

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course at the 2nd autumn semester of the Bachelor's studies.
**Learning outcomes:**
After passing the course, the student will be able to:
* describe of different views on software quality and the role of testing in software engineering,
* detect defects in software using different techniques,
* describe testing levels, and techniques,
* create test cases and conduct unit testing with appropriate testing tools,
* describe the basics of test-driven development and test automation, as well as
* define the scope of software testing and quality assurance projects.

**Contents:**
1. Why Testing and Software quality are important
2. Testing as a process
3. Testing as a technique
4. Designing tests (using testing techniques and domain knowledge)
5. Oracles and Coverage
6. Unit testing and TDD

**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Independent work, Group exercise sessions, Lectures, Project Based Learning, Visiting Lectures from Industry
**Target group:**
BSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses are accomplished: Software Modeling and Design
**Assessment methods and criteria:**
Lab Exercises, Quiz, Final exam, Student project
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Mika Mäntylä
**Working life cooperation:**
Guest lectures when available

## 811312A: Data Structures and Algorithms, 5 op

**Voimassaolo:** 01.08.2010 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Juustila, Antti Juhani

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

| | | |
|---|---|---|
| 521144A | Algorithms and Data Structures | 6.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work.
**Language of instruction:**
Finnish
**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 2nd autumn semester of the Bachelor's studies.
**Learning outcomes:**
After completing the course the student will be able to:
* select data structures and algorithms to an application,
* apply induction when proving algorithm correctness and define recursive algorithms,
* describe trees, graphs and their basic algorithms and apply them in a program,
* describe the most common sorting algorithms, as well as
* analyse the correctness and time complexity of an algorithm implemented in a program.
**Contents:**
* Basic data structures
* Analysis of algorithms
* Sorting algorithms
* Hash tables
* Binary search trees
* Graphs and their algorithms
* Algorithm design paradigms
**Mode of delivery:**
Face-to-face teaching.
**Learning activities and teaching methods:**
Lectures 48 h, exercises 21 h, exercise work 27 h, independent study 39 h.

**Target group:**
BSc students.
**Prerequisites and co-requisites:**

The required prerequisite is that the learning outcomes of the following courses are accomplished: Databases

**Recommended optional programme components:**

**Recommended or required reading:**
Cormen, Leiserson, Rivest, Stein: Introduction to algorithms, Second edition, MIT Press 2001 (or newer) and other material defined during the course.

**Assessment methods and criteria:**
1. Exam and assignment OR 2. Mid-term exams (2) and assignment
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Antti Juustila

## 811325A: Databases, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Iisakka, Juha Veikko

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

| | | |
|---|---|---|
| 811395A | Basics of Databases | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the autumn semester, during period 1. It is recommended to complete the course in the 2nd year autumn semester of the Bachelor's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* apply the theory of the relational databases and the basics of the set theory,
* build a good quality relational database and use queries,
* use a relational database for storing persistent objects,
* use conceptual modelling for designing databases, as well as
* normalise a database and assess its quality.
**Contents:**
* Conceptual modelling
* Relational model and database
* SQL
* Quality of database
* Storing objects to the relational database
**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Lectures 24 h, exercises 16 h, computer exercises 25 h, self-study 68 h
**Target group:**
BSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Programming 2.
**Recommended or required reading:**
Coronel C & Morris S (2018), Database systems : design, implementation, and management, Australia: Cengage Learning

**Assessment methods and criteria:**
Continuous evaluation. The course will be divided to parts. Every part will be evaluated and all parts must pass.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Juha Iisakka

## 811104P: Programming 1, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Lappalainen, Jouni Esko Antero

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

| | | |
|---|---|---|
| ay811104P | Programming 1 (OPEN UNI) | 5.0 op |
| 811122P | Introduction to Programming | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course at the 1st autumn semester of the Bachelor's studies.
**Learning outcomes:**
After completion of this course, the student will be able to:
* create simple working programs
* identify and use the basic control structures of a program.
* identify the concepts of modularity, table, storage of information.
* apply the concepts of modular structure, tables and information storage techniques into a program.
* find and fix errors in the program.
* solve a computational problem by using abstraction and stepwise refinement
* explain the concept of recursion.
* operate with binary and hexadecimal number systems, as well as knows the presentation of numbers on a computer.
* document the program.
**Contents:**
1. Software design method (waterfall) 2. Problem solving 3. Stepwise refinement 4. Control structures 5. Modular programming, calling modules, communication between modules 6. Data types 7. Arrays 8. Pointers 9. Character strings 10. Data structures 11. Storing data.
**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Theory studies at lectures and/or online (in Finnish) 40h, programming exercises in a computer lab and/or an online learning environment 24h, self-study 70h
**Target group:**
BSc students
**Recommended or required reading:**
Deitel, Deitel: C HOW TO PROGRAM; Pearson Education Inc. 2007, or a newer edition. Lecture slides.
**Assessment methods and criteria:**
1. Final exam and exercise points and programming assignment. OR 2. Mid-term exams (2) and exercise points and home programming assignment.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Jouni Lappalainen

## 811322A: Programming 2, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Päivi Raulamo-Jurvanen

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

| | | |
|---|---|---|
| ay811322A | Programming 2 (OPEN UNI) | 5.0 op |
| 812341A | Object-Oriented Programming | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 1st spring semester of the Bachelor's studies.
**Learning outcomes:**
After completion of this course, the student will be able to:
* describe the principles of object paradigm (encapsulation, polymorphism, inheritance, composition), generics, and design patterns and is able to utilise these concepts when creating software,
* describe exception and error management and create fault tolerant programs,
* explain the connection between the UML models and the source code,
* test an application and interpret the structure and functionality of the source code, as well as
* use basic programming tools, such as a version control system, an IDE, and code analysis tools.
**Contents:**
The concept of an object, encapsulation, composition, inheritance, polymorphism, exceptions, UML charts and code, generics (templates), libraries, containers, design patterns, development tools, version control, documenting, unit testing.
**Mode of delivery:**
Face-to-face teaching, can also be implemented as blended teaching
**Learning activities and teaching methods:**
Lectures 32 h and laboratory exercises 24 h (or an equivalent amount of independent learning) plus weekly assignments and independent work 72 h
**Target group:**
BSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses are accomplished: Programming 1
**Recommended or required reading:**
Timothy Budd: Introduction to object-oriented programming, 3rd edition, and other material announced in the beginning of the course.
**Assessment methods and criteria:**
The weekly assignments (preferred) or a final exam in Examinarium + a programming assignment.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Päivi Raulamo-Jurvanen

## 811367A: Programming 3, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Markus Kelanti

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 2nd spring semester of the Bachelor's studies.
**Learning outcomes:**
After completion of this course, the student will be able to:
* recognise the influence and requirements of the interface specification on the server development and is able to apply them in his/her own work.
* implement and document a good quality database and use it in an application.
* iImplement and document the server functionality of a client-server application and apply concurrency when appropriate.
* use existing programming interfaces and message passing protocols in a server application
* test a server application and interpret code written by someone else.
* use programming tools, such as a version control system, an IDE, and code analysis tools in the server development.
**Contents:**
Databases, database programming, data formats, the design, implementation, and testing of a server interface, the safety and security of a server, concurrency.
**Mode of delivery:**
Face-to-face teaching, may also be implemented as blended teaching
**Learning activities and teaching methods:**
Lectures 32 h and laboratory exercises 24 h (or an equivalent amount of independent learning) plus weekly assignments and independent work 72 h
**Target group:**
BSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses are accomplished: Data Structures and Algorithms
**Recommended or required reading:**
Announced in the beginning of the course.
**Assessment methods and criteria:**
Programming assignments and coursework defined during the course.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Markus Kelanti

## 811368A: Programming 4, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Lappalainen, Jouni Esko Antero

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

| | | |
|---|---|---|
| 811375A | User Interface Programming | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**

The course is held in the spring semester, during period 4. It is recommended to complete the course at the 2nd spring semester of the Bachelor's studies.
**Learning outcomes:**
After completion of this course, the student will be able to:
* recognise the influence and requirements of the design/implementation interface on the user interface development process and is able to apply them in his/her own work,
* utilize UI libraries and frameworks in his/her application,
* implement and document the client functionality of a client-server application,
* test the application and test and interpret the code and the application structure with its effects to testing, maintenance and further development,
* use programming tools, such as a version control system, an IDE, and code analysis tools, as well as
* act as a member of a software development team.
**Contents:**
User interface elements, foundations of user interface libraries, user interface design principles, user interface layout, the relationship between user interfaces and software architectures, web usability, web user interfaces, web programming.
**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Exercise 24h, coursework 75h, independent study 35h
**Target group:**
BSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses are accomplished: Programming 3
**Recommended or required reading:**
Provided reading material during the course. 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 with the student during the course), as well as answers to given study questions.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Jouni Lappalainen

## 812362A: Business Process Management and Modelling, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Karin Väyrynen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 2nd spring semester of the Bachelor's studies. The course is not implemented in Academic year 2020-2021.
**Learning outcomes:**
After completing the course, the student will be able to:
* describe the phases and challenges related to the management and modelling of business processes,
* describe how business process are related to teach other,
* make use of different frameworks related to IT process planning,
* identify process-related problems,
* make use of KPI (key performance indicator) thinking when managing and modelling business processes,
* model simple business process on a company-level and process-level, and
* identify most common mistakes related to process modelling.

**Contents:**
Stages of business process management. Aligning business processes with company strategy. Syntax for modellng business processes. Business process modelling tools. Frameworks to support business process management and planning. Business process KPI.
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures 26 h (or exam), exercises 13 h, individual assignments 34 h, team assignment 60 h.
**Target group:**
BSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Information Systems Acquisition, Deployment and Management.
**Recommended or required reading:**
Lecture material, exercise material and other material and literature announced in the course.
**Assessment methods and criteria:**
Active lecture participation (or exam), exercises, individual and team assignments
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Karin Väyrynen

## 812364A: Data Analytics and Business Intelligence, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course at the 3rd spring semester of the Bachelor's studies. The course is not implemented in Academic year 2020-2021
**Learning outcomes:**
After completing the course, the student will be able to:
* explain key data and information concepts and the data and information management lifecycle,
* capture and structure data and information requirements using appropriate conceptual modeling technques,
* develop a logical level represenation of data based on a conceptual model, as well as
* identify the significance of data analytics in business.
**Contents:**
* Key data and information concepts
* Data and information management lifecycle
* Capturing and structuring data and information requirements
* Conceptual modeling techniques
**Mode of delivery:**
face-to-face teaching
**Learning activities and teaching methods:**
Lectures 20 h, independent study of the course literature, weekly tasks and scientific essay 110 h
**Target group:**
BSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Business Process Management and Modelling.
**Recommended or required reading:**
Scientific articles given during the course and other lecture material
**Assessment methods and criteria:**

Active participation in lectures. Weekly tasks. Scientific essay.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Nataliya Shevchuk

## 811166P: Fundamentals to Information Systems, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pasi Karppinen

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

| | | |
|---|---|---|
| ay811166P | Fundamentals to Information Systems (OPEN UNI) | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 1st year autumn semester of the Bachelor's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* use basic concepts of information systems,
* recognize challenges regarding the use of information systems and users,
* describe the basics of organisation, e.g. its structure and function,
* recognize different types of information systems and their roles in an organisation,
* describe how organizational knowledge is formed and recognizes challenges of managing it,
* recognize ethical and social challenges related to information systems,
* describe the role of information systems in leadership and decision making,
* recognize the possibilities of information systems renewal and financial impact of it, as well as
* describe the basics of the history of information systems discipline, its research methods and scientific journals.
**Contents:**
* Basic terms and concepts of information systems.
* Challenges regarding the use of information systems and its users.
* Basics of organisation.
* Types of information systems and their roles in an organisation.
* How knowledge is formed in organizations.
* Ethical and social challenges related to information systems.
* Information systems in decision making process.
* Possibilities of information systems renewal and financial impact of it.
* The history of information systems discipline, its research methods and scientific journals.
**Mode of delivery:**
Online teaching
Covid-19 pandemian vuoksi opetus on kokonaan etäopetuksena syksyllä 2020./ Due to Covid-19 pandemic, teaching in Autumn 2020 will be implemented remotely. Details of arrangement can be found from the course web page, which will be available in Moodle. https://moodle.oulu.fi/course/view.php?id=4498(opens before the start of the course)
**Learning activities and teaching methods:**
Familiarizing lecture material, independent study of the course literature, weekly tasks and scientific essay. Total 133h.
**Target group:**
BSc students
**Recommended or required reading:**
Lecture materials and Laudon, K. C. (2018). Management information systems: Managing the digital firm (Fifteenth edition, global edition.). Harlow, England: Pearson.

Management Information Systems: Managing the Digital Firm, Global Edition
Kenneth C. Laudon; Jane P. Laudon
Pearson International Content
2020

**Assessment methods and criteria:**
Active participation in lectures or online environment. Weekly tasks and scientific essay.

**Grading:**
Numerical scale 1-5 or fail

**Person responsible:**
Liisa Kuonanoja

**Working life cooperation:**
Possibly visiting lecturers from companies and other organizations

## 812363A: Human-Centred Design, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Netta Iivari

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 2nd autumn semester of the Bachelor's studies. The course is not implemented in Academic year 2020-2021.

**Learning outcomes:**
After completing the course, the student will be able to:
* describe the principles and central concepts of human-centered design,
* identify the basic phases and central analysis, design and evaluation methods of human-centered design,
* apply the method in user interface design from the perspective of specific user group and system,
* describe the significance and design of user support,
* descibe the significance of usability, accessibility and universal design, as well as
* identify variety involved in human-centered design

**Contents:**
The principles and central concepts of human-centered design,the basic phases and central analysis, design and evaluation methods of human-centered design, user support, usability, accessibility, universal design, variety involved in human-centered design

**Mode of delivery:**
Face-to-face teaching

**Learning activities and teaching methods:**
Lectures, exercises, groupwork, individual assignments, seminar

**Target group:**
BSc students

**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Information Systems Modelling, Design and Development.

**Recommended or required reading:**
Dix et al. (2003, third or later edition) Human-Computer Interaction, Benyon (2014) Designing Interactive Systems, and lecture and assignment materials.

**Assessment methods and criteria:**
During the course, the students will be carrying out a groupwork assignments and individual tasks. These will be assessed based on the learning outcomes of the course. The assessment criteria and the requirements will be explained in detail during the opening lecture of the course.

**Grading:**
Numerical scale 1-5 or fail

**Person responsible:**

Netta Iivari
**Working life cooperation:**
Guest lectures

## 812361A: Information Systems Acquisition, Deployment and Management, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pasi Karppinen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 2nd year spring semester of the Bachelor's studies. The course is not implemented in Academic year 2020-2021.
**Learning outcomes:**
After completing the course, the student will be able to:
* describe the basics of the procurement process,
* recognize procurement process in the public sector,
* describe how to manage information systems acquisition in an organisation,
* create procurement policies for an organisation,
* create plans and processes to manage information systems' risks,
* understand how important it is to prepare for information system recovery, and how to ensure vital processes in an organisation in a crisis situation. as well as
* create policies how to monitor and control information systems.
**Contents:**
* Procurement process
* Procurement process in the public sector
* Information systems acquisition in an organisation
* Creating procurement policies for an organisation. Plans and processes to manage information systems' risks
* Information system recovery, and how to ensure vital processes in an organisation in a crisis situation
* Creation of policies how to monitor and control information systems
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Independent study of the course literature, learning diary and scientific essay 133 h
**Target group:**
BSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Human-Centred Design.
**Recommended or required reading:**
Selected scientific articles and lecture material
**Assessment methods and criteria:**
Active participation in lectures. Weekly tasks and scientific essay.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Pasi Karppinen
**Working life cooperation:**
Possibly visiting lecturers from companies and other organizations

## 812360A: Information Systems Modelling, Desing and Development, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mikko Rajanen

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay812360A Information Systems Modelling, Desing and Development (OPEN UNI) 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course in the 1st year spring semester of the Bachelor's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* describe the basics of modelling,
* describe the importance of modelling when designing information systems,
* use different kinds of modelling types to represent and design information systems from different points of view,
* use modelling in definition phase of information system design,
* recognize and model stakeholder groups for information system design,
* recognize and model use cases for information system design,
* use modelling in the final parts of the information system design,
* describe the connections between design, modelling and implementation,
* use prototyping and modelling as communication method towards stakeholders, as part of requirement specification and as part of evaluating design concepts, as well as
* recognizes the ethical issues in information system desing and the designer responsibility.
**Contents:**
* Basics of modelling
* Importance of modelling when designing information systems
* Modelling types to represent and design informationsystems from different points of view
* Modelling in definition phase of information system design
* Modelling stakeholder groupsfor information system design
* Modelling use cases for information system design
* Modelling in the final parts of the informationsystem design
* Connections between design, modelling and implementation
* Prototyping and modelling as communication method towards stakeholders, as part of requirement specification and as part of evaluating design concepts
* Ethical issues in information system desing and the designer responsibility.
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures 27 h, exercises 21 h, assignment 85 h, tasks 3 h
**Target group:**
BSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Fundamentals of Information Systems.
**Recommended or required reading:**
Satzinger, Jackson ja Burd (2007), Systems Analysis and Design in a Changing World. Hoffer, George and Valacich (2008), Modern systems Analysis and Design, 5. edition
**Assessment methods and criteria:**
Group assignment which is done and presented in exercises. Tasks that replace exam.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Mikko Rajanen
**Working life cooperation:**

Possibly visiting lecturers from companies and other organizations

## 813307A: IPS (TOL), Maturity Test for Bachelor ‘s Degree, 0 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
0 ECTS credits
**Language of instruction:**
Finnish
**Timing:**
The course is completed when the Bachelor's Thesis is finalised. It is recommended to complete the course at the 3rd spring semester of the Bachelor's studies.
**Learning outcomes:**
According to the Government Decree on University Degrees (794/2004), to be awarded a lower university degree, the student write a maturity essay which demonstrates conversance with in the topic of the thesis and skills in the use of Finnish or Swedish. When a student has been educated in a language other than Finnish or Swedish or a student has been educated abroad, the university shall determine separately the language of the maturity essay.
**Contents:**
Relevant to the topic of the thesis.
**Mode of delivery:**
Self study
**Learning activities and teaching methods:**
The maturity essay is approximately one concept paper (ie four pages or about 500 words). The text should be in the form of an essay addressing the topic of the thesis, and it should be analytical and coherent. In the maturity test, the student presents and analyzes his / her research materials, methods and results.
**Target group:**
BSc students
**Prerequisites and co-requisites:**
Bachelor's Thesis accepted or almost finished.
**Assessment methods and criteria:**
The title of the maturity essay is determined and the essay is evaluated by the Bachelor's Thesis supervisor. A maturity essay may be rejected if it contains significant and repetitive grammatical or other errors.
**Grading:**
Pass or fail
**Person responsible:**
The supervisor of the Bachelor's Thesis

## 811383A: Bachelor Thesis, 7 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
7 ECTS credits / 187 hours of work
**Language of instruction:**
Finnish / English
**Timing:**
Timing of the course is free. It is recommend to complete the thesis at the 3nd spring semester of the Bachelors Studies.
**Learning outcomes:**

After completing the course, the student will be able to:
* produce a step-by-step concrete plan for their own research work and refine it during work;
* retrieve source material from both the library and electronic databases,
* analyze and criticize scientific texts,
* draw their own conclusions from them and create new outlines,
* refer to sources correctly and properly document the sources they use as a source list,
* produce a well-structured scientific text,
* identify emerging problems at work as well as
* seek guidance from a counselor and use the guidance he or she has gained to direct his or her work.

**Contents:**
Conducting literature review independently under supervision.
**Mode of delivery:**
Self study
**Learning activities and teaching methods:**
Conducting and reporting literature review under supervision.
**Target group:**
BSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Introduction to Information Processing Science, Information Skills and Introduction to Research Work.
**Assessment methods and criteria:**
Supervisor accepts the thesis, when it fulfills at least the grade 1 of the programme's criteria for Master's Theses.
**Grading:**
Pass or fail
**Person responsible:**
Researchers and teachers working in the research units in the area of Information Processing Science and qualified as a supervisors according to the programme's criteria.

## 811398A: Bachelor's project, 8 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Kari Liukkunen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the spring semester, during periods 3 - 4. It is recommended to complete the course at the 3rd spring semester of the Bachelor's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* master the principles of a time management and priorisation needed in the project,
* design and to govern the project wholeness with the help of the analytic and systematic thinking,
* work independently according to the objectives of the project,
* identify own strengths and development targets,
* develop himself after the transition to the working life,
* describe the principles of the good project management,
* describe and avoid the challenges of the communication of the multi-cultural community,
* evaluate a group and own production critically,
* find solutions to the most general problem situations of the project activity,
* describe the significance of the customer meeting,
* work as a member of the group in the demanding and changing environment,
* produce documentation and to present them intelligibly, as well as
* describe the possibilities and demands of technical methods of implementation.

**Contents:**

During the course the skills required by the software project are studied in the situation which simulates the practice. The students design and carry out a simple software product. The course initiates the working methods and project practices which are used in the projects. During the course, the students apply to the practice skills that have been learned in their studies.

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Lectures 10 h, seminar 6 h, independent work 117 h

**Target group:**
BSc students

**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Fundamentals of Project Work, Software Arhitectures, Programming 4, as well as Business Process Management and Modelling.

**Assessment methods and criteria:**
Active participation and working in the practice project, projekt group's dokumentation and end product, learning diary

**Grading:**
Numerical scale 1-5 or fail; pass or fail for independent study

**Person responsible:**
Kari Liukkunen

**Working life cooperation:**
The choice of project subjects and the evaluation of final results are carried out together as far as possible with the companies.

## 811397A: Basics of Project Work, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Kari Liukkunen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
Finnish

**Timing:**
The course is held in the autumn semester, during period 4. It is recommended to complete the course in the 2nd spring semester of the Bachelor's studies.

**Learning outcomes:**
After completing the course, the student is able to:
* describe the principles of a time management and priorisation needed in the project,
* work self-directed and to produce material independently ,
* identify its own strengths and its development targets,
* describe the principles of the good project management,
* evaluate group’s and own results critically,
* identify solutions to the most general problem situations of the project,
* make decisions required during the project,
* produce documentation and to present them intelligibly as well as
* find correct and essential information and based on it produce new analyzed information.

**Contents:**
The course gives basic abilities to understand the special characteristics of the projects, phasing, timing, the compilation of the project plan, the realisation of the project and project practices, meeting practices and project reporting.

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Lectures and exercises 40 h, independent work 93 h

**Target group:**

BSc students
**Recommended or required reading:**
All material is provided during the course
**Assessment methods and criteria:**
Participation in lectures, personal reflection reports, course assignments.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Kari Liukkunen

## 811393A: Introduction to research work, 5 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Halonen, Raija Helena

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
Finnish
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 2nd spring semester of the Bachelor's studies.
**Learning outcomes:**
After passing the course, the student will be able to:
* identify the breaks in ethical actions based on observed scientic deception,
* produce text and talk based on done independent work,
* think to apply in future the learnings gained in the course,
* make conscious choices based on options,
* produce text and pictures to make thoughts clearer,
* evaluate and receive and give feedback based on evaluation,
* identify a solution for a simple research problem,
* listen to others and participate in implementing joint goals,
* apply databases to support information search, as well as
* describe concepts and their relations with the help of pictures.
**Contents:**
Introduction, nature of knowledge, concept of research, deception, basics of qualitative, quantitative, constructive and literature research methos, reporting and argumentation, research process and evaluation, reporting of own study and commenting others.
**Mode of delivery:**
Face-to-face teaching.
**Learning activities and teaching methods:**
Lectures 18 h, excercise 33 h, independent work 82 h.
**Target group:**
BSc students.
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Information Skills and Launch Your Career Through Communication.
**Recommended optional programme components:**
It is expected to began Bachelor Thesis work during the course.
**Recommended or required reading:**
Lecture notes, additional articles.
**Assessment methods and criteria:**
Active implementation based on activity and presense & written thesis as guided, active doing during excercise hours, or independent study according to separate guidelines.
**Grading:**
Numerical scale 1-5 or fail; pass or fail for independent study.

**Person responsible:**
Raija Halonen

## 813607S: IPS (TOL), Maturity Test for Master's Degree, 0 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
0 ECTS credits
**Language of instruction:**
Finnish / English
**Timing:**
The course is completed when the Master's Thesis is finalised.
**Learning outcomes:**
According to the Government Decree on University Degrees (794/2004), to be awarded a higher university degree, the student write a maturity essay which demonstrates conversance with in the topic of the thesis and skills in the use of Finnish or Swedish. When a student has been educated in a language other than Finnish or Swedish or a student has been educated abroad, the university shall determine separately the language of the maturity essay.
The student need not demonstrate command of the Finnish or Swedish language in the maturity essay included in the higher university degree if he/she has demonstrated his/her command of the language in a maturity essay included in a lower university degree studied in same language.
**Contents:**
Relevant to the topic of the thesis.
**Mode of delivery:**
Self study
**Learning activities and teaching methods:**
The maturity essay is approximately one concept paper (ie four pages or about 500 words). The text should be in the form of an essay addressing the topic of the thesis, and it should be analytical and coherent. In the maturity test, the student presents and analyzes his / her research materials, methods and results.
If the student is not required to demonstrate command of the Finnish or Swedish language, an abstract of the Master' s thesis will be accepted as showing the required competence instead of writing the text for the maturity test. The student has to write the abstract in a separate form that includes special guidelines for the maturity test. In this case the text does not have to prove the language skills of the student in Finnish or Swedish. However, the text must still show knowledge of the student's field of study.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
Master's Thesis accepted or almost finished.
**Assessment methods and criteria:**
The title of the maturity essay is determined and the essay is evaluated by the Master's Thesis supervisor. A maturity essay may be rejected if it contains significant and repetitive grammatical or other errors.
If the student is not required to demonstrate command of the Finnish or Swedish language, the required abstract form is delivered to the supervisor.
**Grading:**
Pass or fail
**Person responsible:**
The supervisor of the Master's Thesis

## 813613S: Master's Thesis, 30 op

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**ECTS Credits:**
30 ECTS credits / 800 hours of work
**Language of instruction:**
Finnish / English
**Timing:**
Timing of the course is free. It is recommend to complete the thesis at the 2nd autumn semester of the Master's Studies.
**Learning outcomes:**
After completing the thesis, the student will be able to:
* 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 programme guidelines, as well as
* participate in the evolution of ICT and postgraduate studies after completing the thesis.
**Contents:**
Independent research work under supervision aiming at Master's Thesis
**Mode of delivery:**
Self study
**Learning activities and teaching methods:**
Conducting and reporting research work under supervision.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Research Methods.
**Assessment methods and criteria:**
The main supervisor and a second independent reviewer will evaluate the thesis according to the programme's criteria for the Master's Theses.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Researchers and teachers working in the research units in the area of Information Processing Science and qualified as a supervisors according to the programme's criteria.
**Working life cooperation:**
It is recommend choosing a topic that is of interest to a business.

## 817609S: Project Seminar, 3 op

**Voimassaolo:** 01.08.2013 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tonja Molin-Juustila

**Opintokohteen kielet:** English

**ECTS Credits:**
3 ECTS credits / 80 hours of work.
**Language of instruction:**
English.
**Timing:**
The timing of the course is dependent on the Research and Development Project course and must be taken at the same time with it. The course is held in the spring semester, during period 4. It is recommended to complete the course in the 2nd spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the students will be able to:
* demonstrate abilities to gain academic expertise in some challenging topic area of an ICT project,
* search research articles and literature on a ICT topic (review),
* apply research articles and other new knowledge like an academic expert in a selected topic of a project (“Research

and Development Project" course),
* analyse and report practical experiences gained during the project as experience-based new data on the topic to peer students,
* 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, as well as
* act as reflective, independent academic expert in ICT project.

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

**Mode of delivery:**
Blended teaching.

**Learning activities and teaching methods:**
Attendance at the starting lecture (4 h) and the expert seminar (2 full days) is mandatory. Independently writing the seminar paper and preparing the seminar presentation (abt. 60 h).

**Target group:**
MSc students.

**Prerequisites and co-requisites:**
It is required that the student is taking the Research and Development Project at the same time.

**Recommended or required reading:**
Research articles and materials are to be independently 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 in detail will be given at the starting lecture and in the web-based learning environment for the course.

**Grading:**
Numerical scale 1-5 or fail.

**Person responsible:**
Tonja Molin-Juustila

**Working life cooperation:**
Seminar topics are related to the Master's students projects all of which are authentic project works in unique R&D project assignments from a real client (univerisity, companies and organizations like schools, library etc.)

**Other information:**
Enrollment by contacting the responsible person of the course and outlining a draft of the seminar paper before the starting lecture of the course, i.e. until the end of the period 3.

## 817612S: Research and Development Project, 10 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tonja Molin-Juustila

**Opintokohteen kielet:** English

**ECTS Credits:**
10 ECTS credits / 267 hours of work.

**Language of instruction:**
English

**Timing:**
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course in the 2nd spring semester of the Master's studies.

**Learning outcomes:**
After completing the course, the student will be able to:
* demonstrate abilities to work as a professional expert on a challenging ICT project,
* acquire and apply professional expertise in the topic of the project,
* search up to date information on the topic of the project in order to build professional expertise on the topic and apply this in the project work,

* demonstrate skills to conduct an ICT project in a professional way,
* to act as independent professional member of an ICT project and have advanced professionalism in project work and management,
* collectively produce, monitor and update the plan of the project (project with fixed time and human resources),
* build professional working knowledge and skills focused in the topic 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,
* 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), as well as
* 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:**
The topics for the course project can be anything from the ICT field. 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:**
Blended teaching.

**Learning activities and teaching methods:**
Project work 260 h per student. Working hours reported during the project. Attendance at the starting lecture (4 h) is mandatory. Praparing a project portfolio in the end (3 h).

**Target group:**
MSc students.

**Prerequisites and co-requisites:**
The required prerequisite is that the learning ourcomes of the following courses and their predecessors are accomplished: Preparatory Course for MSc Studies (for students selected directly in the Master's Programme) or Fundamentals of Project Work (for students received BSc degree in Information Processing Science from University of Oulu).

**Recommended optional programme components:**
The expertise gained during this project course will be further elaborated during the Project Seminar course, which will immediately follow this course during period 4.

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

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

**Grading:**
Numerical scale 1-5 or fail.

**Person responsible:**
Tonja Molin-Juustila

**Working life cooperation:**
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. during the autumn semester of 2nd study year, until the end of period 1.

## 813627S: Master's Thesis Seminar, 2 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Henrik Hedberg

**Opintokohteen kielet:** English

**Required proficiency level:**

**ECTS Credits:**
2 ECTS credits / 53 hours of work
**Language of instruction:**
English
**Timing:**
The course is held throughout the study year, in all periods. It is recommended to start the course during the 1st study year of the Master's studies, before Master's Thesis.
**Learning outcomes:**
After completing the course, the student will be able to:
* plan a scientific study,
* present own research in various stages, and
* give feedback of peers' research plans and results.
**Contents:**
The course consists of three phases following the structure and progress of a Master's Thesis work:
* previous research and initial research methods,
* data gathering and analysis, as well as
* discussions and conclusions (thesis).
In each phase, a student is required to participate first as a peer reviewer, and then present his/her own research. The course begin with familiarising students with the current reserach topics and methods of the degree programme.
**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Planning and presenting the student’s own research and giving feedback of peers' plans and results 53 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Research Methods
**Recommended optional programme components:**
813613S Master’s Thesis.
**Recommended or required reading:**
Guidelines to producing a Master’s thesis.
**Assessment methods and criteria:**
Acting as a presenter, peer reviewer and audience, as well as compliting the online tasks of an author and a peer reviewer.
**Grading:**
Pass or fail.
**Person responsible:**
Henrik Hedberg
**Working life cooperation:**
Acting as a presenter, peer reviewer and audience, as well as compliting the online tasks of an author and a peer reviewer.

## 813621S: Research Methods, 5 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Netta Iivari

**Opintokohteen kielet:** English

**Leikkaavuudet:**

521146S Research Methods in Computer Science 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course in the 1st spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will able to:
* explain the general principles of scientific research and the practices of scientific methodology,
* generate research problems in information processing sciences,
* identify and describe the main research approaches and methods in information processing sciences, and choose the appropriate approach and method for a research problem,
* evaluate the methodological quality of a research publication, as well as
* 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:**
Blended teaching
**Learning activities and teaching methods:**
Lectures / lecture videos 40 h, exercises 30 h and individual work 65 h. Learning diary is written about the lectures and exercises. Exercises include group work.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering and Information Systems
**Recommended or required reading:**
Lecture slides and specified literature.
**Assessment methods and criteria:**
Accepted learning diary, active participation
**Grading:**
Pass or fail.
**Person responsible:**
Arto Lanamäki

## 811610S: Special Course in Information Processing Science 1, 5 - 10 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Netta Iivari

**Opintokohteen kielet:** English

**ECTS Credits:**
5 - 10 ECTS credits / 133 - 267 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 3. In addition, there may be other implementations around the year, including summer.
**Learning outcomes:**
The learning outcomes of the course vary depending on the content.
**Contents:**
Varying contents related to the Information Processing Science.

**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Varies depending on the content.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering or Information Systems
**Assessment methods and criteria:**
Varies depending on content.
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Programme Director and nominated persons for specific implementations
**Working life cooperation:**
May be organised together with companies or professionals.
**Other information:**
One course implementation is 5 ECTS credits. A student may take at most two different course implementatios and receive 10 ECTS credits.

## 815663S: Software Engineering Research, 5 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Oivo, Markku Tapani

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work.
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course in the 1st spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will able to:
* describe the current research areas in software engineering and the most important software engineering research methods,
* describe academic research and publishing in software engineering,
* critically analyse scientific articles from the viewpoint of the content and research methods used in the article,
* present academic research, as well as
* actively participate in an academic discussion of research papers and research results.
**Contents:**
State of the art research methods and topics in software engineering.
**Mode of delivery:**
Face-to-face teaching.
**Learning activities and teaching methods:**
Lectures and seminars 28 h, exercises / assignments 78 h, weekly study 42 h.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering or Information Systems.
**Recommended or required reading:**

**Assessment methods and criteria:**

Active participation in lectures and attendance. Final grade is composed of attendance, assignments and term paper. No remote participation or distance learning.
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Markku Oivo

## 813607S: IPS (TOL), Maturity Test for Master's Degree, 0 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
0 ECTS credits
**Language of instruction:**
Finnish / English
**Timing:**
The course is completed when the Master's Thesis is finalised.
**Learning outcomes:**
According to the Government Decree on University Degrees (794/2004), to be awarded a higher university degree, the student write a maturity essay which demonstrates conversance with in the topic of the thesis and skills in the use of Finnish or Swedish. When a student has been educated in a language other than Finnish or Swedish or a student has been educated abroad, the university shall determine separately the language of the maturity essay.
The student need not demonstrate command of the Finnish or Swedish language in the maturity essay included in the higher university degree if he/she has demonstrated his/her command of the language in a maturity essay included in a lower university degree studied in same language.
**Contents:**
Relevant to the topic of the thesis.
**Mode of delivery:**
Self study
**Learning activities and teaching methods:**
The maturity essay is approximately one concept paper (ie four pages or about 500 words). The text should be in the form of an essay addressing the topic of the thesis, and it should be analytical and coherent. In the maturity test, the student presents and analyzes his / her research materials, methods and results.
If the student is not required to demonstrate command of the Finnish or Swedish language, an abstract of the Master' s thesis will be accepted as showing the required competence instead of writing the text for the maturity test. The student has to write the abstract in a separate form that includes special guidelines for the maturity test. In this case the text does not have to prove the language skills of the student in Finnish or Swedish. However, the text must still show knowledge of the student's field of study.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
Master's Thesis accepted or almost finished.
**Assessment methods and criteria:**
The title of the maturity essay is determined and the essay is evaluated by the Master's Thesis supervisor. A maturity essay may be rejected if it contains significant and repetitive grammatical or other errors.
If the student is not required to demonstrate command of the Finnish or Swedish language, the required abstract form is delivered to the supervisor.
**Grading:**
Pass or fail
**Person responsible:**
The supervisor of the Master's Thesis

## 813613S: Master's Thesis, 30 op

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** English

**ECTS Credits:**
30 ECTS credits / 800 hours of work
**Language of instruction:**
Finnish / English
**Timing:**
Timing of the course is free. It is recommend to complete the thesis at the 2nd autumn semester of the Master's Studies.
**Learning outcomes:**
After completing the thesis, the student will be able to:
* 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 programme guidelines, as well as
* participate in the evolution of ICT and postgraduate studies after completing the thesis.
**Contents:**
Independent research work under supervision aiming at Master's Thesis
**Mode of delivery:**
Self study
**Learning activities and teaching methods:**
Conducting and reporting research work under supervision.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Research Methods.
**Assessment methods and criteria:**
The main supervisor and a second independent reviewer will evaluate the thesis according to the programme's criteria for the Master's Theses.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Researchers and teachers working in the research units in the area of Information Processing Science and qualified as a supervisors according to the programme's criteria.
**Working life cooperation:**
It is recommend choosing a topic that is of interest to a business.

## 813627S: Master's Thesis Seminar, 2 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Henrik Hedberg

**Opintokohteen kielet:** English

**Required proficiency level:**

**ECTS Credits:**
2 ECTS credits / 53 hours of work
**Language of instruction:**
English
**Timing:**
The course is held throughout the study year, in all periods. It is recommended to start the course during the 1st study year of the Master's studies, before Master's Thesis.

**Learning outcomes:**
After completing the course, the student will be able to:
* plan a scientific study,
* present own research in various stages, and
* give feedback of peers' research plans and results.
**Contents:**
The course consists of three phases following the structure and progress of a Master's Thesis work:
* previous research and initial research methods,
* data gathering and analysis, as well as
* discussions and conclusions (thesis).
In each phase, a student is required to participate first as a peer reviewer, and then present his/her own research.
The course begin with familiarising students with the current reserach topics and methods of the degree programme.
**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Planning and presenting the student’s own research and giving feedback of peers' plans and results 53 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Research Methods
**Recommended optional programme components:**
813613S Master’s Thesis.
**Recommended or required reading:**
Guidelines to producing a Master’s thesis.
**Assessment methods and criteria:**
Acting as a presenter, peer reviewer and audience, as well as compliting the online tasks of an author and a peer reviewer.
**Grading:**
Pass or fail.
**Person responsible:**
Henrik Hedberg
**Working life cooperation:**
Acting as a presenter, peer reviewer and audience, as well as compliting the online tasks of an author and a peer reviewer.

## 811371A: Preparatory Course for MSc Studies, 5 op

**Voimassaolo:** 01.01.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Helena Tokkonen

**Opintokohteen kielet:** English

**Leikkaavuudet:**

811392A Preparatory Course for MSc Studies 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 1. It is recommended to complete the course in the 1st autumn semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* participate in courses requiring basic knowledge of project work,
* 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,

* define the principles of project coordination and communication with the project interest groups,
* consider the principles of referenced and scientific writing, as well as
* use APA referencing.

**Contents:**
The course consists of two parts: project management and scientific writing. In the project part we focus on the people, process and tools of projects in the 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). In the scientific writing part, 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.

**Learning activities and teaching methods:**
Blended teaching online lectures 20 h, independent learning methods 35 h, group work 75 h.

**Target group:**
Msc students
BSc degree from a University of Applied Sciences, a foreign university, etc.
Master's students who have no basic knowledge of project management and/or scientific writing and/or literature reviewing.

**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree

**Recommended optional programme components:**
Especially recommended to take before Master's level project courses.

**Recommended or required reading:**
All material is provided during the course.

**Assessment methods and criteria:**
Active study of online lecture materials, weekly exercises, learning diary and participation in group work assignments.

**Grading:**
Pass or fail

**Person responsible:**
Helena Tokkonen

**Other information:**
Topic: Preparatory Course for MSc Studies Introduction lecture
Time: Sep 2, 2020 02:00 PM Helsinki
Join Zoom Meeting
https://oulu.zoom.us/j/61750761276
Meeting ID: 617 5076 1276
Other information can be found from Moodle. Enrolment key for the course is PCFMS.

## 817609S: Project Seminar, 3 op

**Voimassaolo:** 01.08.2013 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tonja Molin-Juustila

**Opintokohteen kielet:** English

**ECTS Credits:**
3 ECTS credits / 80 hours of work.

**Language of instruction:**
English.

**Timing:**
The timing of the course is dependent on the Research and Development Project course and must be taken at the same time with it. The course is held in the spring semester, during period 4. It is recommended to complete the course in the 2nd spring semester of the Master's studies.

**Learning outcomes:**
After completing the course, the students will be able to:
* demonstrate abilities to gain academic expertise in some challenging topic area of an ICT project,
* search research articles and literature on a ICT topic (review),
* apply research articles and other new knowledge like an academic expert in a selected topic of a project (“Research and Development Project” course),
* analyse and report practical experiences gained during the project as experience-based new data on the topic to peer students,
* 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, as well as
* act as reflective, independent academic expert in ICT project.

**Contents:**
Starting lecture, independent analysis and reporting of the expertise on the selected project topic and an expert seminar (2 full days) with the presentations of each topic.
**Mode of delivery:**
Blended teaching.
**Learning activities and teaching methods:**
Attendance at the starting lecture (4 h) and the expert seminar (2 full days) is mandatory. Independently writing the seminar paper and preparing the seminar presentation (abt. 60 h).
**Target group:**
MSc students.
**Prerequisites and co-requisites:**
It is required that the student is taking the Research and Development Project at the same time.

**Recommended or required reading:**
Research articles and materials are to be independently 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 in detail will be given at the starting lecture and in the web-based learning environment for the course.
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Tonja Molin-Juustila
**Working life cooperation:**
Seminar topics are related to the Master's students projects all of which are authentic project works in unique R&D project assignments from a real client (univerisity, companies and organizations like schools, library etc.)
**Other information:**
Enrollment by contacting the responsible person of the course and outlining a draft of the seminar paper before the starting lecture of the course, i.e. until the end of the period 3.

## 813621S: Research Methods, 5 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Netta Iivari

**Opintokohteen kielet:** English

**Leikkaavuudet:**

521146S Research Methods in Computer Science 5.0 op

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course in the 1st spring semester of the Master's studies.

**Learning outcomes:**
After completing the course, the student will able to:
* explain the general principles of scientific research and the practices of scientific methodology,
* generate research problems in information processing sciences,
* identify and describe the main research approaches and methods in information processing sciences, and choose the appropriate approach and method for a research problem,
* evaluate the methodological quality of a research publication, as well as
* 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:**
Blended teaching
**Learning activities and teaching methods:**
Lectures / lecture videos 40 h, exercises 30 h and individual work 65 h. Learning diary is written about the lectures and exercises. Exercises include group work.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering and Information Systems
**Recommended or required reading:**
Lecture slides and specified literature.
**Assessment methods and criteria:**
Accepted learning diary, active participation
**Grading:**
Pass or fail.
**Person responsible:**
Arto Lanamäki

## 817612S: Research and Development Project, 10 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tonja Molin-Juustila

**Opintokohteen kielet:** English

**ECTS Credits:**
10 ECTS credits / 267 hours of work.
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course in the 2nd spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* demonstrate abilities to work as a professional expert on a challenging ICT project,
* acquire and apply professional expertise in the topic of the project,
* search up to date information on the topic of the project in order to build professional expertise on the topic and apply this in the project work,
* demonstrate skills to conduct an ICT project in a professional way,
* to act as independent professional member of an ICT project and have advanced professionalism in project work and management,
* collectively produce, monitor and update the plan of the project (project with fixed time and human resources),
* build professional working knowledge and skills focused in the topic 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,
* 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), as well as
* 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:**
The topics for the course project can be anything from the ICT field. 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:**
Blended teaching.

**Learning activities and teaching methods:**
Project work 260 h per student. Working hours reported during the project. Attendance at the starting lecture (4 h) is mandatory. Praparing a project portfolio in the end (3 h).

**Target group:**
MSc students.

**Prerequisites and co-requisites:**
The required prerequisite is that the learning ourcomes of the following courses and their predecessors are accomplished: Preparatory Course for MSc Studies (for students selected directly in the Master's Programme) or Fundamentals of Project Work (for students received BSc degree in Information Processing Science from University of Oulu).

**Recommended optional programme components:**
The expertise gained during this project course will be further elaborated during the Project Seminar course, which will immediately follow this course during period 4.

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

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

**Grading:**
Numerical scale 1-5 or fail.

**Person responsible:**
Tonja Molin-Juustila

**Working life cooperation:**
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. during the autumn semester of 2nd study year, until the end of period 1.

## 811602S: Advanced Software Quality and Security, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mika Mäntylä, Alireza Haghighatkhah

**Opintokohteen kielet:** English

**ECTS Credits:**

5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 2nd autumn semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* understand and utilize software quality models,
* understand and utilize some software testing and security techniques, and understand their benefits and limitations, as well as
* apply software testing and security techniques in small scale projects.
**Contents:**
* Testing and quality techniques: Model-based testing, search-based testing, defect prediction, exploratory testing, combinatorial testing, static testing, static analyzers, virtualization, test automation,
* Security Attacks buffer overflows, command injection; Security testing: vulnerability scanning, intrusion detection.
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lecture 16 h, Exercises 24 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Professional Software Engineering Processes and Human Factors.
**Recommended or required reading:**
Lectures, Slides, Articles
**Assessment methods and criteria:**
Assignments, Exercises, Essays
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Alireza Haghighatkhah

## 811373A: Professional Software Engineering Processes and Human Factors, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Minna Isomursu

**Opintokohteen kielet:** English

**Leikkaavuudet:**

| | | |
|---|---|---|
| ay811373A | Professional Software Engineering Processes and Human Factors (OPEN UNI | 5.0 op |
| 815662S | Software Engineering Management, Measurement and Improvement | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 1st autumn semester of the Master's studies.
**Learning outcomes:**
After completing the student will be able to:
* recognize and describe software development processes models,
* evaluate and compare their applicability in different contexts,
* take human factors into account in planning and operating in professional software development,
* analyze their own strengths and improvement areas as software engineers to see opportunities for development, as

well as
* participate in systematic efforts for improvement in software development organizations.
**Contents:**
Module 1: Software development process models. Theory and cases.
Module 2: Human factors in software development. Recognizing individual and team characteristics, and cultivating personal awareness and developement pathways.
Module 3: Software process improvement. Theory and cases.
**Mode of delivery:**
Introduction lecture (not mandatory), online assignments, 2-3 lectures of visiting professionals (not mandatory), seminar (online option)
**Learning activities and teaching methods:**
Individual and group activities.
All materials, assignments and group work will be done online.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Software Development, Maintenance and Operations.
**Recommended or required reading:**
Provided in Moodle.
**Assessment methods and criteria:**
Completing online assignments, active participation in peer feedback
**Grading:**
Pass or fail
**Person responsible:**
Minna Isomursu
**Working life cooperation:**
Visiting lectures of experienced software professionals (2-3)

## 811372A: Software Development, Maintenance and Operations, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mika Mäntylä

**Opintokohteen kielet:** English

**Leikkaavuudet:**

| | | |
|---|---|---|
| ay811372A | Software Development, Maintenance and Operations (OPEN UNI) | 5.0 op |
| 815312A | Software Production and Maintenance | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 1st autumn semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will able to:
* explain and utilize theories of software evolution,
* utilize the processes, techniques and tools for software deployment, and operations,
* utilize the processes, techniques and tools for software maintenance, as well as
* utilize the processes, techniques and tools to better understand and maintain large code bases.
**Contents:**
* Software Maintenance and Evolution
* Software Product Lines
* Software Maintenance and Evolution Models
* DevOps

* Reengineering
* Legacy Systems

**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Lectures (Video): 20 h, exercises / assignments 78 h, weekly study 42 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering and programming.
**Recommended or required reading:**
Videos, books, exercises
**Assessment methods and criteria:**
Exercises, assignements
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Mika Mäntylä

## 811603S: Software Platforms and Ecosystems, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Juustila, Antti Juhani

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 2nd autumn semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* define what are software platforms and ecosystems,
* understand how software platforms and ecosystems can be used for business,
* analyze the benefits and drawbacks of different platforms or ecosystems, as well as
* operate, use and make contributions to a particular software platform or ecosystem.

**Contents:**
* Introduction to software platforms and ecosystems
* Business and strategic aspects of platforms and ecosystems
* Development of software systems utilizing platforms or ecosystems
* Benefits and drawbacks of platforms or ecosystems - business and development views
* Case studies, practical project with a selected platform or ecosystem

**Mode of delivery:**
Lectures, exercises, group work, demonstrations, project work.
**Learning activities and teaching methods:**
Lectures 24 h, exercises or group work 24 h, independent study 52 h, assignments 48 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Advances Software Quality and Security
**Recommended or required reading:**
Announced in the beginning of the course
**Assessment methods and criteria:**

Exam, graded project work and reports, graded assignments.
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Antti Juustila

## 811604S: Software for Intelligent Systems and Artificial Intelligence (AI), 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Minna Isomursu

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course in the 2nd spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the students will be able to:
* reflect and critically assess the role of AI in software intensive services,
* reflect and discuss issues related to design of software intensive services using AI, as well as
* develop a project using the methods and theory learned throughout the course.
**Contents:**
The course consists of four main modules. These are:
* Introduction to the course
* Basics of AI in software intensive services
* AI project, the theme will be decided yearly
* theoretical reflective learnings
**Mode of delivery:**
Introduction lecture, online assignments, final seminar
**Learning activities and teaching methods:**
Individual online assignments, project work executed in groups, peer feedback in seminar
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Software Platforms and Ecosystems
**Recommended or required reading:**
Provided in Moodle
**Assessment methods and criteria:**
Online assignments,  project work with presentation
**Grading:**
Pass or fail
**Person responsible:**
Minna Isomursu

## 811605S: Software-Defined Products, Systems and Services, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tero Päivärinta

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course in the 2nd spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student is able to:
* describe the contemporary main concepts of the "software-defined everything" (SDx) perspective, such as software-defined networks, software-defined storage, software-defined data centers, software-defined computing,
* identify relevant software platforms and tools for developing solutions under the software-defined perspective (cf. the previous main concepts),
* present a service, system or product concept of her/his own interest transformed by the software-defined perspective, as well as
* develop and present a small-scale software project in a group to demonstrate a relevant aspect of the software-defined perspective.
**Contents:**
*Introduction to the main contemporary concepts of SDx ("Software-defined everything")
* Exemplary "software-defined" concepts to re-think products, systems, services
* Examples of typical software tools for implementing some of the related concepts
* Practical project on a selected software-defined concept (presentation and demonstrative implementation) with a selected development environment
**Mode of delivery:**
Lectures, seminar on student-defined concepts, project work, seminar on project presentations
**Learning activities and teaching methods:**
Lectures 12 h (on concepts; potentially guest lectures), Seminars 16 h (of student attendance), Independent study on the selected concept 24 h, project work 90 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Software Platforms and Ecosystems
**Recommended or required reading:**
Announced in the beginning of the course (timely articles and other materials)
**Assessment methods and criteria:**
Individual assignment, project work with presentation. (Depending on the number of students attending, the assignment on the conceptual idea for a new software-defined product, system or service can also be conducted as a part of the group assignment, according to the choice of the teacher.)
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Tero Päivärinta
**Working life cooperation:**
Possibly visiting lectures from companies or other organizations.
**Other information:**
The research groups related to the software-defined timpely projects and solutions can be invited to suggest relevant small-scale project topics for the students.

## 817615S: Creating Domain Value with Data, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pasi Karppinen

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English.
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 2nd spring semester of the Master's studies. The course is not implemented in Academic year 2020-2021.
**Learning outcomes:**
After the course the student will be able to:
* select appropriate data management technologies based on the needs of the domain,
* develop and implement organizational information management policies and processes,
* create an information architecture for an organization,
* integrate and prepare data captured from various sources for analytical use,
* identify appropriate data sources in a heterogeneous environment with multiple data types,
* select and use appropriate analytics methods,
* identify appropriate analytics methods for given tasks,
* use an analytics platform to perform basic analytics tasks,
* analyze data using advanced contemporary methods,
* select and apply advanced computational approaches to identify meaningful patterns and trends,
* build models to support decision-making activities, as well as
* design and implement architectures for organizational content management systems.
**Contents:**
Data management technologies based on the needs of the domain
* Organizational information management policies and processes
* Information architecture for an organization
* Heterogeneous environments with multiple data types
* Different analytics methods
* Analytics platforms
* Different computational approaches to identify meaningful patterns and trends
* Decision support models
* Architectures for organizational content management systems
**Mode of delivery:**
Face-to-face
**Learning activities and teaching methods:**
Lectures 20 h, independent study of the course literature, weekly tasks and scientific essay 110 h.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The recommended prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Societal and Individual Impacts of Information Systems.
**Recommended or required reading:**
Selected scientific articles and lecture material.
**Assessment methods and criteria:**
Active participation in lectures, weekly tasks, scientific essay.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Pasi Karppinen
**Working life cooperation:**
Possibly visiting lecturers from companies and other organizations.

## 812352A: Digitalisation and Innovation, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Piiastiina Tikka

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 1st spring semester of the Master's studies
**Learning outcomes:**
After completing the course, the student will be able to:
* identify and describe what is digitalisation and why it is happening,
* describe how information systems and digitalisation are connected,
* build an overview of organisational/enterprise information systems,
* describe the role of emerging technologies in the society,
* form an overview and describe how innovation takes place, particularly in IT, as well as
* identify opportunities and challenges of future technologies.
**Contents:**
* 1. What is digitalisation? What is digital transformation? Why digitalisation?
* 2. Information systems and digitalisation
* 3. Organisational information systems
* 4. The role of emerging technologies
* 5. The quest for disruptive Zero-to-One innovation
* 6. Core business values
* 7. Innovation strategies and innovation ecosystems
* 8. Opportunities and challenges of future technology
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures and interactive / hands-on exercises, course assignment (design task)
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Information Systems.
**Recommended or required reading:**
"Oinas-Kukkonen H. & Oinas-Kukkonen H.: Humanizing the Web: Change and Social Innovation. Palgrave Macmillan, Basingstoke, UK, 2013. Chapters 7-12.
Other reading matter, to be announced during the course."
**Assessment methods and criteria:**
Exam
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Harri Oinas-Kukkonen

## 817618S: Information Systems Strategy and Leadership, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Marianne Kinnula

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**

The course is held in the spring semester, during period 4. It is recommended to complete the course at the 2nd spring semester of the Master's studies. The course is not implemented in Academic year 2020-2021.
**Learning outcomes:**
After completing the course, the student will be able to:
* describe how to create and implement long-term plans for designing, delivering, and using organizational information systems to achieve strategic domain goals and objectives,
* use different kinds of tools for managing this diverse and ambiguous environment;
* describe the differences between leading and managing and will be able to apply these to practice;
* describe strategic use of information systems in organizations;
* analyse a company situation in a continually changing, unpredictable and even hostile environment, as well as
* make well-grounded recommendations for the company courses of action.
**Contents:**
This course gives an overview of strategic planning for information systems as well as integration of IS strategies with business objectives. Particular attention will then be paid to the tools and frameworks that are available to assist managers in IS strategic analysis and help them understand the strategic impact of technological trends. Issues surrounding business ecosystems and interfirm collaboration will be examined from strategy perspective.
**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Lectures, assignments, independent work, 133h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The recommended prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Creating Domain Value with Data.
**Recommended or required reading:**
Research articles to be announced more specifcally during the course implementation
**Assessment methods and criteria:**
Participation in lectures/exercises, group work, course assignments
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Marianne Kinnula

## 812354A: Servitisation, Co-Creation and Business Development, 5 op

**Voimassaolo:** 01.01.2021 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Karin Väyrynen

**Opintokohteen kielet:** English

**Leikkaavuudet:**

| | | |
|---|---|---|
| ay812354A | Servitisation, Co-creation and Business Development (OPEN UNI) | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 1st autumn semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* develop software business in new businesses and established businesses,
* conduct market analysis to estimate the market potential for the business,
* apply the basics of financial calculation,

* understand differences in business models,
* understand the concept of servitization, as well as
* understand the concept of co-creation.

**Contents:**
The course takes the perspectives of both new businesses and established businesses and their development. Students develop a new software business idea and write a business plan based on the idea. In addition, students are introduced to the concepts of servitization and co-creation, with special focus on already established businesses.

**Mode of delivery:**
Lecture videos, exercises

**Learning activities and teaching methods:**
Lecture videos and independent reading of material 35 hours, exercises 14 hours, individual and team assignments 60 hours, (home) exam 24 hours

**Target group:**
MSc students

**Prerequisites and co-requisites:**
The recommended prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Digitalisation and Innovation

**Recommended or required reading:**
Provided in the digital learning space

**Assessment methods and criteria:**
The final grade is composed of the evaluations of the Business plan (teamwork), other individual/team assignments, and (home) exam.

**Grading:**
Numerical scale 1-5 or fail

**Person responsible:**
Karin Väyrynen

**Other information:**
The first lecture of the course is mandatory for all who want to participate in the course. It will be held on Monday, 26.10., from 14.15-16.00. You can join the lecture via Zoom here: https://oulu.zoom.us/j/67895947285. Please be on time.

Exercises are mandatory (via Zoom, link will be available in Moodle). Make sure you are enrolled to an exercise group, not only to the lectures.

IMPORTANT: Due to the University's requirement to offer the course as distant teaching only, only exercise group 1 (Tuesdays at 8.15-10.00) will be held.
All other lectures except lecture 1, and all lecture material and course information will be available in the Moodle environment of the course.
The Moodle workspace will be available starting from 24.10. here: https://moodle.oulu.fi/course/view.php?id=5204.

The first assignments have to be completed already BEFORE the first exercise (which is held on 3.11.), so make sure you attend the first lecture and complete the first assignments on time.

In the course, there are some assignments that have to be done on a specific day (no change in schedules possible!), so please reserve already now time in your calendars on the following days:
Monday, 16.11.: reserve 2 hours for a course assignment
Monday, 7.12.: reserve 4 hours for a course assignment

Other assignment deadlines will be available in the Moodle workspace upon the start of the course.

## 817619S: Societal and Individual Impacts of Information Systems, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Piiastiina Tikka

**Opintokohteen kielet:** English

**ECTS Credits:**

5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 2nd autumn semester of the Master's studies. The course is not implemented in Academic year 2020-2021.
**Learning outcomes:**
After completing the course the student will be able to:
* understand and discuss the impact of the ICT in the society and changes that take place,
* understand how information systems transform ways of communication and interaction,
* form an overview of how human and societal traits and ICT co-exist, for example, through a series of paradoxes as well as
* gain basic understanding of behaviour change, behaviour analysis and digital intervention design as regards technology.
**Contents:**
1. Introduction to the course
2. Example: How ICT has changed the world
3. The promise
4. IS as a transformer
5. The paradoxes of change
6. Behavior analysis and behavior change
7. Digital intervention design
8. Ethical considerations
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures and exercises, course reading, course assignment
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The recommended prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: User Experience (UX) Design and Management
**Recommended or required reading:**
Book: Oinas-Kukkonen H. & Oinas-Kukkonen H.: Humanizing the Web: Change and Social Innovation. Palgrave Macmillan, Basingstoke, UK, 2013, 248 pages (chapters 1-6).
Other materials (to be distributed during the course).
**Assessment methods and criteria:**
Course assignment (essay) or exam.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Piiastiina Tikka

## 812355A: User Experience (UX) Design and Management, 5 op

**Voimassaolo:** 01.08.2020 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Arhippainen

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the autumn semester, during period 1. It is recommended to complete the course in the 2nd autumn semester of the Master's studies. The course is not implemented in Academic year 2020-2021.
**Learning outcomes:**

After completing the course, the student will be able to:
* describe the significance and is able conceptualize user experience and human interaction with digital products, systems, and services,
* describe the central concepts, factors shaping and potential problems associated with user experience and human interaction with digital products, systems, and services,
* describe various interaction design, user experience design, service design and design thinking methods and use some of them in a practical design case of a novel digital product, system or service as well as
* describe various kinds of management, organizational, social, cultural and political aspects and challenges of user experience design.

**Contents:**
Central concepts (user experience, interaction design, design thinking, service design), human interaction with digital products, systems, and services, various user experience design, interaction design, service design and design thinking methods, management, organizational, social, cultural and political aspects and challenges of user experience design.

**Mode of delivery:**
Face-to-face teaching.

**Learning activities and teaching methods:**
Lectures, exercises, groupwork, individual assignments, seminar

**Target group:**
MSc students

**Prerequisites and co-requisites:**
The recommended prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Servitisation, Co-Creation and Business Development.

**Recommended or required reading:**
Scientific articles and books

**Assessment methods and criteria:**
During the course, the students will be carrying out a groupwork assignments and individual tasks. These will be assessed based on the learning outcomes of the course. The assessment criteria and the requirements will be explained in detail during the opening lecture of the course.

**Grading:**
Numerical scale 1-5 or fail

**Person responsible:**
Netta Iivari

**Working life cooperation:**
Guest lectures, customer assignments

## 811606S: Next Generation Software Engineering, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mika Mäntylä

**Opintokohteen kielet:** English

**Leikkaavuudet:**

| | | |
|---|---|---|
| 811600S | Emerging Trends in Software Engineering | 5.0 op |

**ECTS Credits:**
5 ECTS credits / 133 hours of work

**Language of instruction:**
English

**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course at the 1st spring semester of the Master's studies.

**Learning outcomes:**
After passing the course, a student will be able to:
* descreibe the new trends in software engineering,
* perform computer supported trend mining to discover new trends of any given topic, as well as
* critically think and write about the trends.

**Contents:**
* Software engineering trends (varies)
* Automated trend mining from online databases
* Writing, arguing and discussing about the trends
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures 24 h, exercises 18 h, essays 30 h, project 30 h, independent study 31 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Software Engineering Research.
**Recommended or required reading:**
Articles, lectures, videos
**Assessment methods and criteria:**
Active lecture participation, exercises, assignments, essays
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Mika Mäntylä

## 815663S: Software Engineering Research, 5 op

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Oivo, Markku Tapani

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work.
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course in the 1st spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will able to:
* describe the current research areas in software engineering and the most important software engineering research methods,
* describe academic research and publishing in software engineering,
* critically analyse scientific articles from the viewpoint of the content and research methods used in the article,
* present academic research, as well as
* actively participate in an academic discussion of research papers and research results.
**Contents:**
State of the art research methods and topics in software engineering.
**Mode of delivery:**
Face-to-face teaching.
**Learning activities and teaching methods:**
Lectures and seminars 28 h, exercises / assignments 78 h, weekly study 42 h.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering or Information Systems.
**Recommended or required reading:**

**Assessment methods and criteria:**

Active participation in lectures and attendance. Final grade is composed of attendance, assignments and term paper. No remote participation or distance learning.
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Markku Oivo

## 812650S: Advanced Topics in Digital Cultures and Design, 5 op

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Dorina Rajanen

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 1st spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* describe state-of-the-art research results related to digital cultures and design;
* understand the strengths and limitations of various methods and frameworks used;
* show competence in critiquing research articles published in some of the leading academic journals and conference proceedings;
* show competence in critical thinking, and analysis and synthesis of academic sources;
* show competence in verbally presenting arguments in an academic fashion;
* write a literature review on a relevant research topic;
* acquire knowledge and critically read relevant research articles on digital culture and design related research topics; as well as
* describe ethical aspects involved with work related to digital cultures and design.
**Contents:**
The content of the course will change with time. The initial set of current themes include: 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 such as: 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 20 h, assignments 107 h, seminars 6 h.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering and Information Systems
**Recommended optional programme components:**

**Recommended or required reading:**
Selected scientific articles.
**Assessment methods and criteria:**
Assignments
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Mikko Rajanen

## 812671S: User Experience (UX) and Usability Evaluation, 5 op

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Dorina Rajanen

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work.
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course in the 1st spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* design and follow through a UX/usability evaluation process,
* design test scenarios and tasks,
* select participants,
* plan and follow through the evaluation in laboratory or in the field, as well as
* analyse and report the findings from the evaluations.
**Contents:**
Basic terms and types of UX and usability testing, usability and UX tests process, usability and UX test tasks and scenarios, test subjects, following through a usability and UX tests, analysing usability and UX test material, reporting the findings from usability and UX tests.
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures 24h, assignment tutoring 13h, assignment 90h, seminar 7h.
**Target group:**
MSc students

**Prerequisites and co-requisites:**
The recommended prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Servitisation, Co-Creation and Business Development.
**Recommended optional programme components:**

**Recommended or required reading:**
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 or fail
**Person responsible:**
Mikko Rajanen
**Working life cooperation:**
Students learn how to collaborate with real customers
**Other information:**

## 812651S: ICT and Behaviour Change, 5 op

**Voimassaolo:** 01.08.2011 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Piiastiina Tikka

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 4. It is recommended to complete the course at the 1st spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* grasp the core theories of behaviour change and how they are/can be applied in goal-oriented behaviour change,
* identify and discuss ethical concerns inherent in behaviour change and persuasive systems, and
* identify and discuss the possible negative effects of ICT use not only as regards persuasive systems, but also with social media and other use.
**Contents:**
The focus of the course is role of ICT in supporting people with their endeavours to change their habits or lifestyles. The course introduces the main theories and models regarding behaviour change in order to provide students with a solid base for understanding how behaviour change can also work through ICT. The course also introduces some of the more problematic topics in ICT and behaviour, such as the dark side of ICT use and ethics of persuasion.
The course aims at providing existing knowledge and theoretical starting points to the development and use of persuasive systems. With such base, the student will be able to review the field from a broad perspective with the view to applying appropriate theories and approaches when analysing or developing persuasive systems.
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures 14 h, seminars 20 h, individual and group assignments 100 h; or in self-study mode opening lecture 2 h, assignments 132 h
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The suggested prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Persuasive Systems Design.
**Recommended optional programme components:**
The MSc courses "Persuasive Systems Design" and "Emerging Technologies and Issues" would be helpful, but is not required.
**Recommended or required reading:**
Research articles to be announced more specifcally during the course implementation
**Assessment methods and criteria:**
Course assignment
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Piiastiina Tikka
**Working life cooperation:**
-

## 811607S: Persuasive Systems Design, 5 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Oinas-Kukkonen, Harri Ilmari

**Opintokohteen kielet:** English

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 3. It is recommended to complete the course at the 1st spring semester of the Master's studies.
**Learning outcomes:**
After passing the course a student will be able to:
* analyze methods and techniques employed by persuasive systems,
* apply such methods in an ethical manner as design guidelines for developing persuasive ICT solutions, as well as
* apply gamification as persuasive design principles for serious games and other similar solutions.
**Contents:**
Attitudinal theories from social psychology have been quite extensively applied to the study of user intentions and behaviour. These theories have been developed mostly for predicting user acceptance of information technology rather than for providing systematic analysis and design methods for developing software solutions that aim at attitude or behaviour change. At the same time a growing number of information technology systems and services are being developed for these purposes.
This course will focus on persuasive technology. It will address the process of designing and evaluating persuasive systems, the types of content and software functionality in such systems, the underlying assumptions behind these, methods for analysing the persuasion context, and principles for persuasive system design. The course also looks into the methods and techniques of gamifying persuasive content.
The course is primarily geared towards analysis and design tasks using the Persuasive Systems Design model as the main approach. Gamification forms another segment of the course, introducing topics in the role of games and game-like experiences in supporting persuasion.
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures 20h, readings before lectures 21h, personal reflective exercises 21h, supervisory meetings 14h, project assignment 48h, other course related activity 10h.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering and Information Systems
**Recommended optional programme components:**
This course offers good groundwork for ICT and Behaviour Change course, but is not compulsory.
**Recommended or required reading:**
Research articles to be announced more specifcally during the course implementation
**Assessment methods and criteria:**
Participation in lectures, personal reflection reports, course assignments.
**Grading:**
Numerical scale 1-5 or fail
**Person responsible:**
Harri Oinas-Kukkonen

## 812649S: Advanced Research Methods, 5 op

**Voimassaolo:** 01.08.2016 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Faculty of Information Technology and Electrical Engineering

**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:**
The course is held in the spring semester, during periods 3 and 4. It is recommended to complete the course at the 2nd spring semester of the Master's studies.
**Learning outcomes:**
After completing the course, the student will be able to:
* describe the background, philosophical assumptions and guiding principles of quantitative, qualitative and design science research, their role in information systems and software engineering research and the variety involved in them;
* evaluate the strengths and weaknesses of the research approaches and methods in relation to her or his research topic as well as select the suitable approach and methods;
* use more advanced data analysis methods;
* prepare a research plan for a research project, including formulating research problems, specifying research designs and choosing appropriate data collection and analysis methods for solving the problems;
* describe state-of-the-art ways of reporting the results;
* evaluate the methodological quality of her or his research and research publications more generally; as well as
* search more information on research methods from scientific literature as well as to adapt and refine methods for her or his research problems and interests.
**Contents:**
Introduction to qualitative, quantitative and design science research in information systems and software engineering, their scientific background,
philosophical assumptions and guiding principles, variety involved in them, relationships between the research approaches and associated frameworks, methods, processes and practices, advanced data analysis methods, reporting and evaluating research within the approaches.
**Mode of delivery:**
Face-to-face teaching
**Learning activities and teaching methods:**
Lectures 16 h, exercises 12 h, seminar 18 h, individual and group assignments 100 h
**Target group:**
MSc students, PhD students
**Prerequisites and co-requisites:**
The required prerequisite is that the learning outcomes of the following courses are accomplished: Research Methods. In addition, the student must have a preliminary thesis topic.
**Recommended optional programme components:**
Recommended to take before Master's thesis.
**Recommended or required reading:**
Selected scientific articles or research method books.
**Assessment methods and criteria:**
Assignments
**Grading:**
Pass or fail
**Person responsible:**
Netta Iivari

## 811330A: Project management, 5 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Kari Liukkunen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
5 ECTS credits / 133 hours of work
**Language of instruction:**
English, interaction with a project team may be in Finnish
**Timing:**
The course is held in the spring semester, during periods 3 - 4. Optional course. It is recommended to complete the course in the 1st spring semester of the Master's studies.

**Learning outcomes:**
After completing the course, the student will be able to:
* master the principles of a time management and priorisation needed in the project,
* gather information on the progress of a project and based on it, make project related decisions,
* apply theory on project management in practice,
* recognise risks of software projects and prepare for them,
* work as a project manager, as well as
* communicate with stakeholders by using both written and spoken language.

**Contents:**
Lectures give student tools to lead a software project focusingon leadership skills and common problem situations in project work.

**Mode of delivery:**
Blended teaching

**Learning activities and teaching methods:**
Lectures 10 h and indpendent work 123 h

**Target group:**
MSc students

**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree and has knowledge how to participate in a project as a team member.

**Assessment methods and criteria:**
Active participation in management training, succesfully leading project and drawing up the project plan and the learning diary.

**Grading:**
Numerical scale 1-5 or fail

**Person responsible:**
Kari Liukkunen

**Working life cooperation:**
Project topics are usually connected to companies

## 816630S: Scientific paper writing, 1 - 3 op

**Voimassaolo:** 01.08.2008 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Henrik Hedberg

**Opintokohteen kielet:** English

**ECTS Credits:**
2 - 5 ECTS credits / 53 - 133 hours of work

**Language of instruction:**
Finnish or English

**Timing:**
Timing of the course is free. Student will search for the paper topic and supervisor on his/her own.

**Learning outcomes:**
After completing the course, the student will be able to:
* author a scientific paper under supervision.

**Contents:**
The course supports other research courses, where an opportunity to writing a scientific research article is given.

**Mode of delivery:**
Self study

**Learning activities and teaching methods:**
The course is realized under a supervision of a chosen supervisor, whose permission must be obtained before starting the course.

**Target group:**
MSc students

**Prerequisites and co-requisites:**
The recommended prerequisite is that the learning outcomes of the following courses and their predecessors are accomplished: Research Methods

**Recommended optional programme components:**
A scientic publication may be produced based on the Master's Thesis.
**Assessment methods and criteria:**
A student or a student team may obtain credits from this course when the paper is accepted by the supervisor for a submission to a conference or journal. The supervisor's statement is delivered to the responsible person, who gives the cource credits.
**Grading:**
Pass or fail
**Person responsible:**
Programme Director
**Other information:**
The numbers of credits are based on the contribution of the author, quality of the paper and the demand level of the publication forum.

## 811610S: Special Course in Information Processing Science 1, 5 - 10 op

**Voimassaolo:** 01.08.2019 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Netta Iivari

**Opintokohteen kielet:** English

**ECTS Credits:**
5 - 10 ECTS credits / 133 - 267 hours of work
**Language of instruction:**
English
**Timing:**
The course is held in the spring semester, during period 3. In addition, there may be other implementations around the year, including summer.
**Learning outcomes:**
The learning outcomes of the course vary depending on the content.
**Contents:**
Varying contents related to the Information Processing Science.
**Mode of delivery:**
Blended teaching
**Learning activities and teaching methods:**
Varies depending on the content.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
The required prerequisite is that the student has completed BSc degree as well as has basic knowledge on Software Engineering or Information Systems
**Assessment methods and criteria:**
Varies depending on content.
**Grading:**
Numerical scale 1-5 or fail.
**Person responsible:**
Programme Director and nominated persons for specific implementations
**Working life cooperation:**
May be organised together with companies or professionals.
**Other information:**
One course implementation is 5 ECTS credits. A student may take at most two different course implementatios and receive 10 ECTS credits.

## 814601S: Work Experience in ICT responsibilities, 5 op

**Voimassaolo:** 01.08.2010 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Practical training

**Vastuuyksikkö:** Information Processing Science DP

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Tonja Molin-Juustila

**Opintokohteen kielet:** Finnish

**ECTS Credits:**
3-5 ECTS credits / 2–4 months of full time work
**Language of instruction:**
Finnish or English.
**Timing:**
Timing of this course is free. Recommended to take as a summer course. The course is also suitable for the supported work placement studies. In that case, it is recommended to search for the work placement and apply for the support already at the turn of the year.
**Learning outcomes:**
After completing the course, the student will be able to:
* master certain part of professional ICT work in enterprises or public organisations,
* analyse and reflect on the work experience with Information Processing Science studies, as well as
* write an informative report on his/her work experience.
**Contents:**
Working from two to four months in professional ICT responsibilities that require university level studies.
**Mode of delivery:**
Self study
**Learning activities and teaching methods:**
The student is responsible for making the needed arrangements for the internship: search for the work placement, negotiate job contract, prepare the support application when needed, follow the agreed labor agreement, work within the agreed responsibilities as well as study independently the needed professional skills and knowledge. In addition, the student documents his/her internship according to the course requirements weekly.
**Target group:**
MSc students
**Prerequisites and co-requisites:**
Information Processing Science or related studies, which enable their practical application in the context of professional ICT responsibilities.
**Recommended or required reading:**
Studies and selected course materials related to the internship in professional ICT responsibilities.
**Assessment methods and criteria:**
Working in professional ICT responsibilities from two to four months. Work experience can be realized in several periods, which all are processed as independent internship periods. The work experience is proved by delivering a signed letter of reference from the employer(s). The letter of reference contains details of the internship period and the student’s primary duties and responsibilities. After the internship period, experiences are reported as soon as possible. An internship report consists of description of realized work and analysis of learning outcomes in relation to the studies taken in Information Processing Science. 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 as well. Based on the internship period, student will gain 3-5 ECTS credits (2 months = 3, 3 months = 4, 4 months = 5).
In addition to above, student may also document his/her personal plan and learning goals for the internship period as well as report weekly implementation status of those plans and goals. In this case, 5 ECTS credits will be gained already from 2 months’ internship period. For applying the financial support, this documentation is mandatory.
**Grading:**
Pass or fail
**Person responsible:**
Tonja Molin-Juustila
**Working life cooperation:**
Working on professional ICT responsibilities.
**Other information:**
Documenting guidelines and templates are available in the course materials. Before the internship starts, the support application must be recorded in the university systems with the copy of the internship agreement. The letter of reference from the employer(s) will be recorded together with the credits.