

## Koulutuksen toteuttamissuunnitelma

### Koulutuksen kurssien ajoitus

Master's Degree		2017		2018				2019			
		Syksy		Kevät		Syksy		Kevät		Syksy	
		1	2	3	4	1	2	3	4	1	2
<b>Common Courses</b>		<b>Cr</b>									
811392A	Preparatory Course for MSc Studies	2	2								
815312A	Software Production and Maintenance	5		5							
811344A	<i>Tilastollisen data-analyysin perusteet tietojenkäsittelytieteilijöille</i>	5		5							
813630S	Software Business Development	5		5							
815303A	Embedded Software Development Environments	5			5						
811391A	<i>Vaatimusmäärittely</i>	5			5						
813626S	<i>Emerging Technologies and Issues</i>	5			5						
815311A	Software Quality and Testing	5				5					
813621S	Research Methods	5				2	3				
811600S	Emerging Trends in Software Engineering	5				2	3				
815663S	Software Engineering Research	5				3	2				
815657S	Open Source Software Development	5				3	2				
815662S	Software Engineering Management, Measurement and	5					5				
811601S	<i>Emerging Trends in Software Testing</i>	5						5			
817614S	Software Factory Project	10						5	5		
817609S	Project Seminar	3								3	
812331A	<i>Interaction Design</i>	5								5	
817602S	Software Development in Global Environments	5								3	2
813613S	Master's Thesis	30						5	10	4	11
813627S	Master's Thesis Seminar	2									2
813607S	Maturity Test	0									0
		0	2	15	15	15	15	15	15	15	15
		2		30		30		30		30	
				32				60		30	
											122

**Valinnaiset kurssit merkitty punaisella:**  
*opiskelija voi valita näiden tilalle toisen kurssin tarjonnan rajoissa henkilökohtaisen opintosuunnitelmansa (HOPS) mukaisesti.*

Kurssien kuvaukset on kuvattu jäljempänä. Niistä selviää toteuttamistavat, osaamistavoitteet, sisällöt, opetusmenetelmät, työelämä yhteistyömuodot sekä arviointikriteerit.

## Opinto-ohjelman kurssikuvaukset

### 811392A: Preparatory course for MSc studies, 2 op

**Opiskelumuoto:** Aineopinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Arto Lanamäki

**Laajuus:**

2 ECTS credits / 53 hours of work.

**Opetuskieli:**

English.

**Ajoitus:**

The course is held in the autumn semester, during period 1. It is recommended to complete the course in the 1<sup>st</sup> autumn semester.

**Osaamistavoitteet:**

After completing the course, the student is able to participate in courses requiring basic knowledge of project work. The student is able to apply the basic concepts of project work, act in different roles in projects and is able to describe the significance of the different project outcomes, such as project plan, mid-reports and final reports. The student is able to define the principles of project coordination and communication with the project interest groups. Additionally, the student is able to consider the principles of referenced and scientific writing.

**Sisältö:**

The focus of the course is in the people, process and tools of a project in information technology field. Course covers the basic principles of project management, planning, coordination and communication within the project as well as outside the project. Course presents the different outcomes of the project, related to internal and external communication – project plans, mid-report, final reports and other project specific outcomes, as well as internal reports, memos and non-written communication and coordination techniques in a project. The latter include unofficial and official meetings held within the project as well as among the external interest groups of the project (for example, customers and the project steering group). Finally, the course presents the basics of written referenced and scientific communication – how to use references, how to acknowledge work of others, how to format an article and what is plagiarism and how to avoid plagiarism.

**Järjestämistapa:**

Blended teaching.

**Toteutustavat:**

Lectures and exercises 20 h, independent learning methods 34 h

**Kohderyhmä:**

Msc students. The course is mandatory for GS3D students, and recommended for students with a Finnish University of Applied Sciences (AMK) background.

**Yhteydet muihin opintoihin:**

Especially recommended to take before Master's level project courses.

**Oppimateriaali:**

Provided when the course starts

**Suoritustavat ja arviointikriteerit:**

Active participation in the lectures and exercises; learning diary.

**Arviointiasteikko:**

Pass or fail.

**Vastuhenkilö:**

Arto Lanamäki

## **815312A: Software Production and Maintenance, 5 op**

**Opiskelumuoto:** Aineopinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Mika Mäntylä

**Laajuus:**

5 ECTS credits/133 hours of work

**Ajoitus:**

The course is held in the spring semester, during period 3. It is recommended to complete the course in the 1<sup>st</sup> spring semester.

**Osaamistavoitteet:**

After completing the course, the student:

Can apply the framework of product line engineering in large scale software production;

Can apply the maintenance process and techniques in software production.

**Sisältö:**

Product line engineering: 1. Product line variability; 2. Domain engineering; 3. Application engineering; 4.

Transition strategies and organisational issues. Principles and practices of software evolution and maintenance

**Järjestämistapa:**

Face-to-face teaching

**Toteutustavat:**

Lectures 24 h, exercises/ assignments 18 h, weekly study and learning diary 4 2h, term project 45 h.

**Kohderyhmä:**

MSc students

**Esitietovaatimukset:**

Basic knowledge of software engineering and software architectures.

**Oppimateriaali:**

Pohl, K., Böckle, G., van der Linden, F. Software Product Line Engineering. Foundations, Principles, and Techniques, Springer-Verlag, 2005; chapters 1-5, 10, 15, 19-20. Chastek G.J., Donohoe P., McGregor J.D., Formulation of a Production Strategy for a Software Product Line, Technical Note CMU/SEI-2009-TN-025, Carnegie Mellon, 2009. Software Evolution and Maintenance, Priyadarshi Tripathy, Kshirasagar Naik, ISBN: 978-0-470-60341-3, 416 pages, January 2015.

**Suoritustavat ja arviointikriteerit:**

Active Participation to lectures and attendance. Final grade is composed of attendance, learning diary, assignments and term project.

**Arviointiasteikko:**

Numerical scale 1-5 or fail.

**Vastuuhenkilö:**

Mika Mäntylä

**811344A: Tilastollisen data-analyysin perusteet tietojenkäsittelytieteilijöille, 5 op**

**Opiskelumuoto:** Aineopinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Ari Vesänen

**Laajuus:**

5 op/133 tuntia opiskelijan työtä.

**Opetuskieli:**

suomi

**Ajoitus:**

Opintojakso järjestetään kevätlukukaudella, periodilla 3. Suositeltava suoritusajankohta opintojaksolle on 3. vuoden kevätlukukausi.

**Osaamistavoitteet:**

Opintojakson suoritettuaan opiskelija osaa tunnistaa ja kuvata tilastollisten aineistojen ominaisuudet ja perustyytit sekä hyödyntää niitä tietojenkäsittelytieteisiin liittyvissä tehtävissä. Opiskelija osaa määrittellä kvantitatiivisia mittareita ja käsitellä tilastollisia muuttujia. Hän osaa myös kuvata ja analysoida tilastollisia aineistoja perusmenetelmillä sekä raportoida tuloksia. Opiskelija tuntee myös R-kielen perusteet ja osaa hyödyntää sitä tilastollisissa analyyseissä.

**Sisältö:**

Tilastollisten aineistojen tyytit, mittarit ja muuttujat, tiedonkeruumenetelmät, otanta, tilastollisen aineiston hallinta, kuvailevat tunnusluvut, hypoteesin testaus, data-analyysin perusteet, tilastollisen aineistojen graafinen esittäminen, tilastollisten analyysien raportointi, R perusteet.

**Järjestämistapa:**

Lähiopetus.

**Toteutustavat:**

Luennot 36 h, harjoitukset 18 h ja itsenäinen työskentely 80 h.

**Kohderyhmä:**

Kandidaattivaiheen opiskelijat.

**Oppimateriaali:**

Luentokalvot, annettu kirjallisuus ja harjoitustehtävät.

Kirjallisuus: Blaikie (2003), Analyzing Quantitative Data; Wild & Seber (2000), Chance Encounters;

Venables, Smith & the R Core Team (2014), An Introduction to R

Muuta kurssilla annettua kirjallisuutta

**Suoritustavat ja arviointikriteerit:**

Opintojakso arvioidaan hyväksytysti suoritettuna tentin ja harjoitustehtävien perusteella.

**Arviointiasteikko:**

Numeerinen asteikko 1-5 tai hylätty.

**Vastuhenkilö:**

Ari Vesanen

**813630S: Software Business Development, 5 op**

**Opiskelumuoto:** Syventävät opinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Karin Väyrynen

**Laajuus:**

5 ECTS credits/134 hours of work

**Opetuskieli:**

English

**Ajoitus:**

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

**Osaamistavoitteet:**

The course provides insights to business development on a business, company and industry level. After completing the course, the student is able to plan how business is being developed over the whole life cycle of the business and company, conduct market and business analyses, identify different sources of financing for business operation, evaluate different strategic business options and select a business model adequate for the present and future situation of the company.

**Sisältö:**

The course takes three points of view: company start-up, established business, and software industry. The course introduces the concepts of business idea, business plan, software business models and strategies, and the software value network.

**Järjestämistapa:**

Face-to-face teaching

**Toteutustavat:**

Lectures 24h, exercises 12h, course assignments 78h, exam 20h. The course assignments will be conducted as group work.

**Kohderyhmä:**

**Esitietovaatimukset:**

The recommended prerequisite is the completion of the following courses prior to enrolling for the course unit: 811174P Introduction to Software Business, 813316A Business Process Modelling and 813620S Software Business and IT Management.

**Oppimateriaali:**

Refer to the course web pages

**Suoritustavat ja arviointikriteerit:**

This course unit utilizes continuous assessment. Lectures are for the most part voluntarily, but participation is recommended. The students will write course assignments which will be assessed. In addition, there will be an exam at the end of the course which will be assessed. The assessment of the course unit is based on the learning outcomes of the course unit.

**Arviointiasteikko:**

1–5

**Vastuhenkilö:**

Jukka Kontula

**815303A: Embedded Software Development Environments, 5 op**

**Opiskelumuoto:** Aineopinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Juustila, Antti Juhani

**Laajuus:**

5 ECTS credits / 133 hours of work

**Ajoitus:**

The course is held in the spring semester, during period 4. It is recommended to complete the course at the 1<sup>st</sup> spring semester.

**Osaamistavoitteet:**

After completing the course, a student is able to work with the essential software development tools of a selected embedded platform. The student is able to implement memory and power efficient applications by exploiting existing libraries and knowledge of the programming interfaces provided by the platform.

**Sisältö:**

The focus of the course is in the software development environments and tools for mobile and embedded platforms, such as Android and iOS. In addition, the course covers memory and power management, core services of the platform, networking and the utilisation of existing libraries. One platform will be selected for deeper study, and the course introduces its essential software development tools and libraries. The emphasis is on application development for the platform as an exercise.

**Järjestämistapa:**

Blended teaching

**Toteutustavat:**

Lectures and exercises about 40 h, exercises and exercise work 93 h.

**Kohderyhmä:**

MSc students

**Esitietovaatimukset:**

Course "815309A Real-time Distributed Software Development", C/C++ and/or Java programming skills or similar knowledge obtained from other courses.

**Oppimateriaali:**

Course material, the documentation of selected technologies, and other related literature

**Suoritustavat ja arviointikriteerit:**

Exercise work

**Arviointiasteikko:**

Numerical scale 1-5 or fail.

**Vastuhenkilö:**

Antti Juustila

**811391A: Vaatimusmäärittely, 5 op**

**Opiskelumuoto:** Aineopinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Jouni Markkula

**Laajuus:**

5 op/133 tuntia opiskelijan työtä

**Opetuskieli:**

Suomi

**Ajoitus:**

Opintojakso järjestetään syyslukukaudella, periodilla 2. Suositeltava suoritusajankohta opintojaksolle on 3. vuoden syyslukukausi.

**Osaamistavoitteet:**

Kurssin suoritettuaan opiskelija osaa tarkastella vaatimuksia problem domain- ja solution domain - näkökulmista ja ymmärtää näkökulmien asettamat erityispiirteet vaatimuksille. Opiskelija ymmärtää, mikä rooli problem ja solution-domainissa esitetyillä vaatimuksilla on asiakkaan ja toimittajan näkökulmasta; kykenee tunnistamaan erilaisia projektityyppisiä ja tietää millaiset vaatimukset mikäkin projektityyppi edellyttää. Opiskelija hallitsee useita vaatimusmäärittelyjen kuvaustapoja, niiden hyviä ja huonoja puolia eri näkökannoilta, ja osaa käyttää muutamia tärkeimpiä kuvaustekniikoita. Opiskelija hallitsee useita vaatimusten tunnistus-/hankintatekniikoita ja osaa käyttää niistä tavanomaisimpia. Lisäksi opiskelija hallitsee vaatimusten hallinnan sekä vaatimusten validoinnin ja verifiointin periaatteet tuotteen elinkaaren aikana.

**Sisältö:**

Vaatimusten käyttötarkoituksia. Vaatimusmäärittelyjen keruu-, analysointi- ja kuvaustekniikat. Vaatimusten validointi ja verifiointi. Vaatimuksista neuvottelu ja priorisointi. Julkaisun suunnittelu. Vaatimusten hallinta tuotteen elinkaaren aikana.

**Järjestämistapa:**

Lähiopetus

**Toteutustavat:**

Luennot 32 h, viikkotehtävät ja harjoitustyö n. 102 h.

**Kohderyhmä:**

Kandidaattivaiheen opiskelijat.

**Esitietovaatimukset:**

Kurssilla oletetaan osattavan vähintään perustiedot ja -taidot seuraavista kursseista: "811169P Tietojärjestelmien suunnittelun perusteet", "812346A Oliosuuntautunut analyysi ja suunnittelu", "811380A Tietokantojen perusteet", "811335A Ohjelmistotekniikka" sekä "812334A Tietojärjestelmien suunnittelu".

**Yhteydet muihin opintojaksoihin:****Oppimateriaali:**

S. Lauesen, Software Requirements – Styles and Techniques. Pearson Education 2002; luvut 1-4 ja 6-9.

A.M. Davis, Just Enough Requirements Management, Dorset House Publishing 2005; otteita. Luentokalvot.

**Suoritustavat ja arviointikriteerit:**

Kurssin suorittamiseen on kaksi vaihtoehtoista tapaa: 1) Aktiivinen osallistuminen: viikkotehtävät ja harjoitustyö, 2) Perinteinen tentti.

**Arviointiasteikko:**

Numeerinen asteikko 1-5 tai hylätty.

**Vastuhenkilö:**

Jouni Markkula

**813626S: Emerging Technologies and Issues, 5 op**

**Voimassaolo:** 01.08.2015 -

**Opiskelumuoto:** Syventävät opinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Piiastiina Tikka

**Laajuus:**

5 ECTS credits / 133 hours of work.

**Opetuskieli:**

English

**Ajoitus:**

The course is held in the autumn semester, during period 1.

**Osaamistavoitteet:**

After completing the course, the student is able to :

Analyse the on-going changes in online and consumer behaviour, customer requirements, ICT markets and technological development;

Evaluate key enabling web technologies and become an effective participant in web-enabled business endeavours and initiatives;

Design ways for leveraging information and communication technologies to improve intra- and interorganisational

processes and enhance a firm's competitive position;

Plan ways for searching innovations; and

Develop his/her skills for building careers and taking advantage of entrepreneurial opportunities through emerging technologies, in particular related to the web.

**Sisältö:**

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

**Järjestämistapa:**

Face-to-face teaching

**Toteutustavat:**

Lectures 24h, exercises 8h, reflective personal exercises 21h, independent work and exam (required reading) 80h.

**Kohderyhmä:**

MSc students

**Esitietovaatimukset:**

None

**Yhteydet muihin opintojaksoihin:****Oppimateriaali:**

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

**Suoritustavat ja arviointikriteerit:**

Exam.

**Arviointiasteikko:**

Numerical scale 1-5 or fail.

**Vastuuhenkilö:**

Piiastiina Tikka

**815311A: Software Quality and Testing, 5 op**

**Opiskelumuoto:** Aineopinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Muhammad Farooq

**Laajuus:**

5 ECTS credits / 133 hours of work.

**Opetuskieli:**

English

**Ajoitus:**

The course is held in the autumn semester, during period 1. It is recommended to complete the course in the 1<sup>st</sup> autumn semester.

**Osaamistavoitteet:**

The student understands different views on software quality and the role of testing as a part of software engineering validation and verification activities, and defect identification/ removal techniques. The student knows testing levels, strategies and techniques, can create test cases and conduct unit testing with appropriate testing tools. The student knows the basics of test driven development and test automation.

**Sisältö:**

Software quality and quality assurance. Software quality management and metrics. Fundamental concepts of software testing. Functional and structural testing. Unit, integration, system, acceptance and regression testing. Hands on test-driven development. Test automation

**Järjestämistapa:**

Face-to-face teaching

**Toteutustavat:**

Lectures 24 h, exercises/ assignments 24 h, weekly study 42 h, term project 42 h

**Kohderyhmä:**

MSc students

**Esitietovaatimukset:**

Working knowledge of Java programming language is required. Basic knowledge of software engineering.

**Yhteydet muihin opintojaksoihin:**

**Oppimateriaali:**

Pezze M., Young M., "Software Testing and Analysis: Process, Principles and Techniques", John Wiley&Sons, 2008 \*\*\* Lasse Koskela, "Test Driven: Practical TDD and Acceptance TDD for Java Developers", Manning Publications, 2007 \*\*\* • Galin D., "Software Quality Assurance: From theory to implementation", Addison-Wesley, 2004

**Suoritustavat ja arviointikriteerit:**

Active Participation to lectures and attendance. Final grade is composed of attendance, assignments and term project. No remote participation or distance learning.

**Arviointiasteikko:**

Numerical scale 1-5 or fail.

**Vastuuhenkilö:**

Muhammad Farooq

**813621S: Research Methods, 5 op**

**Opiskelumuoto:** Syventävät opinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Arto Lanamäki

**Laajuus:**

5 ECTS credits / 133 hours of work

**Opetuskieli:**

English

**Ajoitus:**

The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course in the 1st autumn semester.

**Osaamistavoitteet:**

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

**Sisältö:**

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.

**Järjestämistapa:**

Face-to-face teaching, lecture videos

**Toteutustavat:**

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

**Kohderyhmä:**

MSc students

**Esitietovaatimukset:**

Completion of Bachelor's studies

**Oppimateriaali:**

Lecture slides and specified literature

**Suoritustavat ja arviointikriteerit:**

Accepted learning diary

**Arviointiasteikko:**

Pass or fail

**Vastuhenkilö:**

Arto Lanamäki

**811600S: Emerging Trends in Software Engineering, 5 op**

**Opiskelumuoto:** Syventävät opinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Mika Mäntylä

**Laajuus:**

5 ECTS credits /133 hours of student work

**Opetuskieli:**

English

**Ajoitus:**

The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 1st autumn semester.

**Osaamistavoitteet:**

After completing the course, a student understands the recent trends in software engineering. The student is able to argue and discuss the significance of the trends to one's own work and to software engineering discipline in general. The student is able to perform trend mining to discover new trends.

**Sisältö:**

- Software engineering trends (varies yearly) - Trend mining - Writing, arguing and discussing about the trends

**Järjestämistapa:**

Face-to-Face teaching.



**Toteutustavat:**

Lectures 24 h, exercises 18 h, essays 30 h, project 30 h, independent study 31 h

**Kohderyhmä:**

MSc students

**Esitietovaatimukset:**

Basics on software engineering

**Yhteydet muihin opintojaksoihin:**

No

**Oppimateriaali:**

Articles + lectures.

**Suoritustavat ja arviointikriteerit:**

Active lecture participation, exercises, assignments, essays.

**Arviointiasteikko:**

Numerical scale 1-5 or fail.

**Vastuhenkilö:**

Mika Mäntylä

**815663S: Software Engineering Research, 5 op**

**Opiskelumuoto:** Syventävät opinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Muhammad Ahmad, Oivo, Markku Tapani

**Laajuus:**

5 ECTS credits / 133 hours of work.

**Opetuskieli:**

English

**Ajoitus:**

The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course in the 2nd autumn semester.

**Osaamistavoitteet:**

After completing the course the student will know the current research areas in software engineering and the most important software engineering research methods. The student understands academic research and publishing in software engineering, and is able to critically analyse scientific articles from the viewpoint of the content and research methods used in the article. The student is able to present academic research and actively participate in an academic discussion of research papers and research results.

**Sisältö:**

State of the art research methods and topics in software engineering.

**Järjestämistapa:**

Face-to-face teaching

**Toteutustavat:**

Lectures and seminars 28 h, exercises/ assignments 78 h, weekly study 42 h

**Kohderyhmä:**

MSc students

**Esitietovaatimukset:**

B.Sc. or other equivalent degree

**Oppimateriaali:**

**Suoritustavat ja arviointikriteerit:**

Active Participation to lectures and attendance. Final grade is composed of attendance, assignments and term paper. No remote participation or distance learning.

**Arviointiasteikko:**

Numerical scale 1-5 or fail.

53

**Vastuhenkilö:**

Markku Oivo and Muhammed Ovais Ahmad

**815657S: Open Source Software Development, 5 op**

**Opiskelumuoto:** Syventävät opinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl  
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**Opettajat:** Henrik Hedberg

**Laajuus:**

5 ECTS credits / 133 hours of work

**Opetuskieli:**

English

**Ajoitus:**

The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course in the 1st autumn semester.

**Osaamistavoitteet:**

After passing the course, a student will be able to - define the historical background and the ideology of Open Source Software (OSS), - participate in an OSS development project, - evaluate the impact of the usage of OSS and OSS licenses on software development and exploitation, and - view the phenomenon through the essential scientific research.

**Sisältö:**

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

perspectives, for example, what OSS is and what it is not, the history and organisation of OSS projects, methods of OSS development and usage, as well as licensing models and possible risks. The emphasis is on research work.

**Järjestämistapa:**

Blended teaching.

**Toteutustavat:**

Lectures and seminars about 40 h, exercises and peer reviews about 20 h, seminar article and presentation about 70 h

**Kohderyhmä:**

MSc students

**Esitietovaatimukset:**

Compulsory prerequisites are Bachelor degree or other equivalent degree and basic knowledge on software engineering and research work.

**Oppimateriaali:**

Fogel, K. (2005): Producing Open Source Software - How to Run a Successful Free Software Project, O'Reilly Media; Rosen L. (2004): Open Source Licensing: Software Freedom and Intellectual Property Law, Prentice Hall; scientific

articles covering the topic.

**Suoritustavat ja arviointikriteerit:**

Active participation, seminar article and other assignments

**Arviointiasteikko:**

Numerical scale 1-5 or fail.

**Vastuhenkilö:**

Henrik Hedberg

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

**Opiskelumuoto:** Syventävät opinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Oivo, Markku Tapani

**Laajuus:**

5 ECTS credits / 133 hours of work.

**Ajoitus:**

The course is held in the autumn semester, during period 2. It is recommended to complete the course in the 2<sup>nd</sup> autumn semester.

**Osaamistavoitteet:**

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

Understand professional software development processes in agile, lean and traditional environments - Evaluate different methods and techniques; - Select from them appropriate ones for different software engineering environments; -Have capabilities to participate in systematic efforts for improvement in software companies.

**Sisältö:**

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

**Kohderyhmä:**

MSc students

**Esitietovaatimukset:**

B.Sc. or other equivalent degree and basic knowledge of software engineering

**Oppimateriaali:**

CMMI: Guidelines for Process Integration and Product Improvement. Mary Beth Chrissis, Mike Konrad, Sandy Shrum. Addison-Wesley, ISBN 032-115496-7, 2004.

Agile Project Management with Scrum. Ken Schwaber, Microsoft Press, ISBN 0-7356-1993-X. 2004.

Dingsøyr T., Dybå T., Moe N.B., Agile Software Development: Current Research and Future Directions, Springer, 2010.

Jones, Applied Software Measurement: Global Analysis of Productivity and Quality, 3rd ed. McGraw-Hill/Osborne Media, 2008.

Craig Larman and Bas Vodde, Scaling Lean & Agile Development: Thinking and Organizational Tools for Large-Scale Scrum, Addison-Wesley, 2009

**Suoritustavat ja arviointikriteerit:**

Active and regular participation to lectures and seminars AND report evaluation AND seminar presentations

**Arviointiasteikko:**

Numerical scale 1-5 or fail.

**Vastuhenkilö:**

Markku Oivo

**Työelämäyhteistyö:**

Yes, visiting lecture from industry.

**811601S: Emerging Trends in Software Testing, 5 op**

**Opiskelumuoto:** Syventävät opinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Mika Mäntylä

**Laajuus:**

5 ECTS credits / 133 hours of work.

**Opetuskieli:**

English

**Ajoitus:**

The course is held in the spring semester, during period 3.

**Osaamistavoitteet:**

After completing the course, a student understands advanced software testing techniques, their benefits and limitations. The student is also able to apply these techniques in practice to simple software testing problems with software test automation tools.

**Sisältö:**

Advanced testing techniques: Model-based testing, search-based testing, mutation, exploratory testing, combinatorial testing, static testing, static

analyzers, test environments, virtualization, OS system containers, test automation.

**Järjestämistapa:**

Face-to-face teaching

**Toteutustavat:**

Lectures 24 h, exercises 18 h, lecture questions 15 h, lab reports 15 h, project 30h

**Kohderyhmä:**

MSc students

**Esitietovaatimukset:**

Basics on software testing.

**Yhteydet muihin opintojaksoihin:**

**Oppimateriaali:**

Articles + lectures.

**Suoritustavat ja arviointikriteerit:**

Active lecture participation, exercises, assignments, term project.

**Arviointiasteikko:**

Numerical scale 1-5 or fail

**Vastuhenkilö:**

Mika Mäntylä

## **817614S: Software Factory Project, 10 op**

**Opiskelumuoto:** Syventävät opinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Oivo, Markku Tapani

**Laajuus:**

10 ECTS credits / 267 hours of work.

**Opetuskieli:**

English

**Ajoitus:**

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.

**Osaamistavoitteet:**

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

**Sisältö:**

Starting lectures (4x2h) and two workshops (2x8h), 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 lectures. The project work will take two periods (one semester).

**Järjestämistapa:**

Blended teaching.

**Toteutustavat:**

Project work 260 h per student. Working hours reported during the project. Attendance at the starting lectures (8 h) and workshops (16 h) is mandatory.

**Kohderyhmä:**

MSc students.

**Esitietovaatimukset:**

Mandatory: B.Sc. degree or other equivalent degree. Students enrolling directly to the Master's programme should take the "Preparatory course for MSc studies (811392A)" course first (see the timetable for the autumn semester, period 1) or otherwise master the basics of project work and management as in Pressman, R.S. Software Engineering: A Practitioner's Approach, the chapters related to project management.

**Oppimateriaali:**

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

**Suoritustavat ja arviointikriteerit:**

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

**Arviointiasteikko:**

Numerical scale 1-5 or fail.

**Vastuhenkilö:**

Markku Oivo

**Työelämäyhteistyö:**

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

### **817609S: Project Seminar, 3 op**

**Opiskelumuoto:** Syventävät opinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Tonja Molin-Juustila

**Laajuus:**

3 ECTS credits / 80 hours of work.

**Opetuskieli:**

English.

**Ajoitus:**

The timing of the course is dependent on the Research and Development Project (817612S) course and will immediately follow the project in the next semester, during period 3. It is recommended to complete the course at the 2nd spring semester.

**Osaamistavoitteet:**

After completing the course, the students should demonstrate their abilities to work as academic experts in challenging ICT projects. Students will learn to acquire and apply research articles and other new knowledge like an academic expert in a selected topic of their project ("Research and Development Project" course). Students will also learn to analyse and report their experience-based new knowledge on the topic to peer students. By completing this course, students are able to act as reflective, independent academic experts in ICT projects and have learnt expertise in some topic area of their project. As an expert in the selected topic area, the student is able to: search research articles and literature on the topic (review); report practical experiences gained during the project on the topic; evaluate the results of the project and reflect the practical experiences against previous literature and research on the topic; disseminate the (increased) expertise in the topic in a credible way to peers both by a written report and orally.

**Sisältö:**

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

**Järjestämistapa:**

Blended teaching.

**Toteutustavat:**

Attendance at the starting lecture (4 h) and the expert seminar (1-2 full days) is mandatory. Independently writing the seminar paper and preparing the seminar presentation (abt. 50 h).

**Kohderyhmä:**

MSc students.

**Esitietovaatimukset:**

Mandatory: Research and Development Project (817612S) during autumn semester, periods 1&2. This course will immediately follow the project course on the project topics. For the students of the Master's degree programme on Software, Systems, and Service Development (GS3D), Software Factory Project Course (817611S) is mandatory before this course.

**Oppimateriaali:**

Research articles and materials are to be independently collected and studied by the students.

**Suoritustavat ja arviointikriteerit:**

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.

**Arviointiasteikko:**

Numerical scale 1-5 or fail.

**Vastuhenkilö:**

Tonja Molin-Juustila

**Työelämäyhteistyö:**

Seminar topics are related to the Master's students projects all of which are authentic project works in unique R&D project assignments from real customers (university, companies and organizations like schools, library etc.)

## **812331A: Interaction Design, 5 op**

**Opiskelumuoto:** Aineopinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Netta Iivari

**Laajuus:**

5 ECTS credits/133 hours of work

**Opetuskieli:**

English

**Ajoitus:**

The course is held in the autumn semester, during period 1. It is recommended to complete the course at the 1<sup>st</sup> autumn semester.

**Osaamistavoitteet:**

**Objective:** The course explains the role of human interaction with IT products, systems, and services, explains the factors and problems related to it to motivate interaction design, and teaches some user-centered methods for analysis, evaluation and design of interactions.

**Learning Outcomes:** After completing the course, the student can assess the role of human interaction with IT products, systems, and services and identify factors and problems related to it within a practical design case. The student is able to: use methods for analysis and evaluation of existing interfaces; understand the role of requirements, plan and conduct a simple requirements collection and analysis; use basic principles of usability and user experience for user interface design; use interaction design methods in designing for target user experiences.

**Sisältö:**

The course provides an overview of interaction design, introducing the terminology and fundamental concepts, the main activities, and the importance of user involvement in the design process. The course addresses establishing requirements for IT products, systems, and services. The focus is on usability and user experience from the viewpoint of the intended users, their tasks and the context of use. The course covers user-centered methods for designing for and evaluating usability and user experience of IT products, systems, and services. All the main activities of interaction design are carried out in a practical design case.

**Järjestämistapa:**

Face-to-face teaching, self-study

**Toteutustavat:**

Lectures 20 h, exercises and seminar 25 h, individual and group assignments 90 h; or self-study: an opening lecture 2 h, one larger assignment 110 h and individual tasks 21 h.

**Kohderyhmä:**

MSc students

**Esitietovaatimukset:**

Basic knowledge on human-computer interaction with usability and user-centered design.

**Yhteydet muihin opintoihin:**

Basic knowledge on human-computer interaction with usability and user-centered design.

**Oppimateriaali:**

Sharp et al. (2015) Interaction Design, chapters 1-2, 4-5, 7-13 (pages 1-64, 100-157, 226-473)

**Suoritustavat ja arviointikriteerit:**

Accepted assignments.

**Arviointiasteikko:**

Numerical scale 1-5 or fail.

**Vastuuhenkilö:**

Netta Iivari

**Työelämäyhteistyö:**

Invited lectures, assignments

**817602S: Software Development in Global Environment, 5 op**

**Opiskelumuoto:** Syventävät opinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Kuvaja, Pasi Oskari

**Laajuus:**

5 ECTS credits / 133 hours of work

**Opetuskieli:**

English

**Ajoitus:**

The course is held in the autumn semester, during periods 1 and 2. It is recommended to complete the course in the 1st autumn semester.

**Osaamistavoitteet:**

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

**Sisältö:**

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

**Toteutustavat:**

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

**Kohderyhmä:**

MSc students

**Esitietovaatimukset:**

Basic knowledge of academic writing technique is needed. Basic understanding of software business is an advantage.

**Oppimateriaali:**

To be announced during the course implementation.

**Suoritustavat ja arviointikriteerit:**

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

**Arviointiasteikko:**

Numerical scale 1-5 or fail

**Vastuuhenkilö:**

Pasi Kuvaja

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

**Opiskelumuoto:** Syventävät opinnot

**Laji:** Lopputyö  
**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala  
**Arvostelu:** 1 - 5, hyv, hyl

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

**Opiskelumuoto:** Syventävät opinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

**Opettajat:** Henrik Hedberg

**Lähtötaaso vaatimus:**

**Laajuus:**

2 ECTS credits / 53 hours of work (1 ECTS / 27 hours of work for GS3D students)

**Opetuskieli:**

Finnish or English

**Ajoitus:**

The course is held throughout the study year, in all periods. It is recommended to start the course during the 1<sup>st</sup> study year, before Master's Thesis.

**Osaamistavoitteet:**

By completing this course the student can - plan a scientific study, - present own research in various stages, and -give feedback of peers' research plans and results.

**Sisältö:**

The course consists of three phases following the structure and progress of a Master's Thesis work: 1) previous research and initial research methods (research plan), 2) data gathering and analysis, as well as 3) 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.

**Järjestämistapa:**

Face-to-face teaching.

**Toteutustavat:**

Planning and presenting the student's own research and giving feedback of peers' plans and results 53 h (27 h for GS3D students)

**Kohderyhmä:**

MSc students

**Yhteydet muihin opintoihin:**

813613S Master's Thesis

**Oppimateriaali:**

Guidelines to producing a Master's thesis.

**Suoritustavat ja arviointikriteerit:**

Active participation in at least nine (six for GS3D students) seminar sessions. One session lasts about three hours and they are arranged during the semesters according to the plan published on the website.

**Arviointiasteikko:**

Pass or fail.

**Vastuhenkilö:**

Henrik Hedberg

### **813607S: Maturity Test, 0 op**

**Opiskelumuoto:** Syventävät opinnot

**Laji:** Opintojakso

**Vastuuyksikkö:** Tietojenkäsittelytieteiden ala

**Arvostelu:** 1 - 5, hyv, hyl

## **Valinnaiset opinnot, joista voi valita HOPS:iin, ajallisen tarjonnan rajoissa**

521150A: Internetin perusteet, 5 op

811396A: Johdatus tutkimustyöhön, 3 op

811379A: Käyttöliittymien perusteet, 5 op

811375A: Käyttöliittymäohjelmointi, 5 op

813316A: Liiketoimintaprosessien mallintaminen, 5 op

815345A: Ohjelmistoarkkitehtuurit, 5 - 6 op



811346A: Ohjelmistotekniikka, 5 op  
812339A: Olio-ohjelmoinnin jatkokurssi, 5 op  
812341A: Olio-ohjelmointi, 5 op  
812342A: Oliosuntautunut analyysi ja suunnittelu, 5 op  
812305A: Organisaatioiden informaatiojärjestelmät, 5 op  
812332A: Tietojärjestelmien suunnittelu, 5 op  
811394A: Tietokantajärjestelmät, 5 op  
811395A: Tietokantojen perusteet, 5 op  
811312A: Tietorakenteet ja algoritmit, 5 op  
812315A: Ohjelmiston rakentaminen, 10 op  
815338A: Ohjelmointikielten periaatteet, 5 op  
814311A: Työharjoittelu ICT-tehtävissä, 1 - 5 op  
815663S: Software Engineering Research, 5 op  
812649S: Advanced Research Methods, 5 op  
812650S: Advanced Topics in Human-Centred Design, 5 op  
817604S: ICT and Organizational Change, 5 op  
813620S: Ohjelmistoliiketoiminnan johtamisen ajankohtaiset teemat, 5 op  
812670S: The Next Generation of the Web, 5 op  
814601S: Työharjoittelu, 5 op