



# Programme Syllabus for Software Engineering and Management Master's programme, 120 credits

Software Engineering and Management masterprogram, 120 högskolepoäng

*Second Cycle/N2SOF*

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## 1. Confirmation

The syllabus is confirmed by the IT Faculty Board 2016-09-08. This syllabus is to be valid from 2017-08-28 (autumn semester 2017).

The Division of Software Engineering at the Department of Computer Science is responsible for the study programme.

## 2. Purpose

The aim of the programme is to train professional software engineers who can contribute constructively to both the software industry and society at large. Qualifications after the programme prepares well for different roles involved in the development of software such as developers, testers, quality manager, software architect, project manager, as well as for further studies at the university, for example graduate studies.

The profile of the programme is characterized by the combination of advanced technical knowledge with managerial skills to be able to produce large technologically advanced systems in ways that correspond to contemporary demands for quality and speed in very dynamic environments. In the programme, different perspectives and approaches are applied together to educate qualified engineers who can design software with high quality and at low development and maintenance cost, and future researchers who can work innovatively and conduct advanced experiments with technology within software engineering.

A central pedagogical philosophy in the programme is to collaborate closely with industry through, for example, project work and guest lectures where the students are confronted with authentic and realistic projects and challenges that respond to relevant needs and requirements of industry.

### **3. Entry requirements**

Bachelor's degree 180 credits including an independent project (degree project) of at least 15 credits or equivalent within the field of Software Engineering, Computer Science, Computer Engineering, Information Technology, Information Systems, or equivalent.

Knowledge in programming, with the minimum of:

- 7.5 credits in programming
- 4.5 credits in object-oriented design,
- 7.5 credits in algorithms and data structures, and
- 15 credits in practical projects are required.

English 6/English B from Swedish Upper Secondary School or equivalent.

#### **Specific entry requirements for admission to a course within the study programme**

Within the study programme there can be specific entry requirements for admission to individual courses. These specific entry requirements are documented in each course syllabus and state which entry requirements are necessary to be registered on a course within the study programme.

#### **Selection**

Selection is according to the Higher Education Ordinance and the University of Gothenburg admission regulations for education on first and second cycle.

### **4. Higher education qualification and main field of study**

Main field of study for the programme is Software Engineering.

After the completion of the programme of 120 credits, of which 75 credits are specialized study in the main field Software Engineering, on request, a degree certificate is issued with the designation Degree of Master of Science (120 credits) with a major in Software Engineering. For a Degree of Master of Science the student must have accomplished an independent project (degree project) of at least 30 credits within the main field of study.

### **5. Outcomes**

Second-cycle courses and study programmes shall be based fundamentally on the knowledge acquired by students during first-cycle courses and study programmes, or its equivalent.

Second-cycle courses and study programmes shall involve the acquisition of specialist knowledge, competence and skills in relation to first-cycle courses and study programmes, and in addition to the requirements for first-cycle courses and study programmes shall:

- further develop the ability of students to integrate and make autonomous use of their knowledge,
- develop the students' ability to deal with complex phenomena, issues and situations, and
- develop the students' potential for professional activities that demand considerable autonomy, or for research and development work.

(The Swedish Higher Education Act (Ordinance 2006:173), chapter 1, section 9.)

## **5.1. Outcomes for Degree of Master of Science (120 credits) according to the Higher Education Ordinance**

### **Knowledge and understanding**

For a Degree of Master of Science (120 credits) the student shall

- demonstrate knowledge and understanding in the main field of study, including both broad knowledge of the field and a considerable degree of specialised knowledge in certain areas of the field as well as insight into current research and development work, and
- demonstrate specialised methodological knowledge in the main field of study.

### **Competence and skills**

For a Degree of Master of Science (120 credits) the student shall

- demonstrate the ability to critically and systematically integrate knowledge and analyse, assess and deal with complex phenomena, issues and situations even with limited information
- demonstrate the ability to identify and formulate issues critically, autonomously and creatively as well as to plan and, using appropriate methods, undertake advanced tasks within predetermined time frames and so contribute to the formation of knowledge as well as the ability to evaluate this work
- demonstrate the ability in speech and writing both nationally and internationally to clearly report and discuss his or her conclusions and the knowledge and arguments on which they are based in dialogue with different audiences, and
- demonstrate the skills required for participation in research and development work or autonomous employment in some other qualified capacity.

### **Judgement and approach**

For a Degree of Master of Science (120 credits) the student shall

- demonstrate the ability to make assessments in the main field of study informed by relevant disciplinary, social and ethical issues and also to demonstrate awareness of ethical aspects of research and development work
- demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used, and
- demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

(Higher Education Ordinance, Qualifications Ordinance, Annex 2)

## 5.2. Local outcomes

### Knowledge and understanding

For a Degree of Master of Science (120 credits) with a major in Software Engineering the student shall

- recognize the complexity of requirements management and be able to identify, prioritize, package and validate requirement specifications,
- identify theoretical and practical aspects of
  - verification and validation methods in software engineering, exemplified by automated testing, static verification, formal specifications or inspections,
  - development, assessment and improvement of different types of architectures in modern software,
  - project management: project planning, execution and finalization,
  - quality assurance: planning, execution and follow-up,
  - model based development and testing, and
  - dedicated tools for the abovementioned knowledge.

### Competence and skills

For a Degree of Master of Science (120 credits) with a major in Software Engineering the student shall

- be able to design new processes adapted to modern types of software, e.g. embedded systems and to use modern tools to specify and communicate processes, and
- apply theoretical knowledge and practical skills relevant to research methodology within Software Engineering.

### Judgement and approach

For a Degree of Master of Science (120 credits) with a major in Software Engineering the student shall

- analyse existing processes for development of software and be able to identify improvements in processes concerning selected aspects, e.g. productivity, quality, and
- analyse how different roles interact with each other in software development processes and implications of personal characteristics of humans for optimizing the composition of a project group.

## 6. Content and structure

The programme consists of courses in Software Engineering and related subjects. The programme includes a total of 120 credits. Of these are 75 credits compulsory courses in the main field of Software Engineering, including 30 credits independent project (thesis), and at least 15 credits of elective courses in the same main field. Furthermore, the programme includes a maximum of 30 credits of optional courses outside the main field that are selected within or outside courses offered in the programme. A student, who wishes to include courses within the main field outside the course offerings of the programme, shall consult with the programme management.

The courses are progressively arranged so that they, within the framework of learning outcomes, contribute separately and jointly, with developing the student's skills and abilities in the field.

Knowledge in the main field is attained in an initial basic block. Thereafter follows a successive deepening and broadening or specialization through elective courses offered within and outside the main field. Through this progression, the students deepen their scientific and theoretical basis in the field of software engineering.

The education is conducted in the form of lectures, seminars, teacher-led exercises, and tutoring as well as projects in which students apply and deepen their knowledge. The literature is in English and all teaching and communication is in English.

The education is given at full time. An academic year is divided into two semesters and four study periods. A semester includes two study periods, each of 15 credits. Students normally attend two courses in parallel in each study period.

### **Study process**

The first semester includes only compulsory courses in Software Engineering and introduces key elements and characteristics in the area of software engineering. During the second semester elective courses in the main field of Software Engineering are offered, which focus on advanced technical skills and approaches to deal with complexity.

For a master degree the student shall include the following compulsory courses:

- DIT276 Requirements Engineering, 7.5 credits
- DIT847 Software Quality, 7.5 credits
- DIT844 Project Management, 7.5 credits
- DIT278 Empirical Software Engineering, 7.5 credits
- DIT599 Software Evolution Project, 15 credits
- DIT551 Master Thesis Software Engineering, 30 credits or DIT555 Master Thesis in Computer Science and Engineering, 60 credits

The above courses constitute the main field within the education programme. The course Master Thesis Software Engineering includes an independent project (degree project) of 30 credits.

In addition to the above compulsory courses, the student should study at least 15 credits of the following elective courses<sup>1</sup>:

- DIT542 Advanced Software Architecture, 7.5 credits
- DIT191 Agile Development Processes, 7.5 credits
- DIT596 Model Driven Engineering, 7.5 credits
- DIT848 Model-Based Testing, 7.5 credits
- TIAxxx Governance and Control for Digital Capabilities, 15 credits
- TIAxxx Organizing for Digital Transformation, 15 credits
- TIA150 Communication among professionals, 7.5 credits
- DITxxx Applied Machine Learning 7.5 credits
- DITxxx Techniques for Large-scale Data 7.5 credits
- TIG095, Human-Computer Interaction, 7.5 credits
- TIA243 Designing User Experiences, 7.5 credits

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<sup>1</sup> Many courses mentioned above are still preliminary and will be confirmed during the coming years.

- TIA098 Gameplay Design, 7.5 credits

Furthermore, the programme includes four optional courses of a total of 30 credits.

A student can apply for an alternative study process. This can be preparatory for research or development work. See table 2 for alternative study process year two.

**Table 1. The following schema shows the ordinary study process with compulsory, elective and optional courses arranged in the four study periods:**

Year	Study period 1–2		Study period 3–4	
1	DIT276 Requirements Engineering 7.5 credits*	DIT844 Project Management 7.5 credits*	alternatively elective/optional course**	alternatively elective/optional course**
	DIT847 Software Quality 7.5 credits*	DIT278 Empirical Software Engineering 7.5 credits*	alternatively elective/optional course**	alternatively elective/optional course**
2	DIT599 Software Evolution Project 15 credits*		DIT551 Master Thesis Software Engineering 30 credits*	
	optional course	optional course		

Courses marked with \* are compulsory.

Courses marked with \*\* are elective of which at least two shall be selected.

**Table 2. The following schema shows the alternative study process: this alternative includes a master thesis of 60 credits.**

The application process is described on the following web site: <http://www.cse.chalmers.se/MasterThesis/>

Year	Study period 1–2		Study period 3–4	
1	DIT276 Requirements Engineering 7.5 credits*	DIT844 Project Management 7.5 credits*	alternatively elective/optional course**	alternatively elective/optional course**
	DIT847 Software Quality 7.5 credits*	DIT278 Empirical Software Engineering 7.5 credits*	alternatively elective/optional course**	alternatively elective/optional course**
2	DIT555 Master's Thesis in Computer Science and Engineering 60 credits*			

Courses marked with \* are compulsory.

Courses marked with \*\* are elective of which at least two shall be selected.

### Elective and optional courses

Within the programme, the students can study elective courses to an extent of 45 credits. These include elective courses in the main field of Software Engineering of at least 15 credits. Further elective courses within the programme can be selected with guaranteed admission. These enable students to specialize in different areas. Available areas for specialization are for example:

- Software, architecture, product och process management
- Software and modeling
- Software, strategi och leadership
- Software and communication
- Software and data science
- Software and user experience

Optional courses outside the main field can be selected to a maximum of 30 credits. These can be selected at University of Gothenburg or another university within or outside Sweden. Students who wish to study optional courses within the main field but outside those offered within the programme shall consult the programme management.

## **7. Guaranteed admission**

Students who follow the study programme at the prescribed rate have guaranteed admission. There are two kinds of guaranteed admission at the University of Gothenburg: general or limited.

‘General guaranteed admission’ means that the students admitted to the study programme have guaranteed admission to all of the compulsory and optional courses in the programme syllabus provided that specific entry requirements are fulfilled and the student applies to the course within the study programme within the prescribed application period.

‘Limited guaranteed admission’ means that the students cannot be guaranteed their first-choice place for optional courses.

For optional courses outside the study programme local admission regulations are valid and there is no guaranteed admission.

## **9. Transitional regulations**

For older courses that may be included in a Degree of Master of Science (120 credits) with a major in Software Engineering, see the local degree description for the Degree of Master of Science with a major in Software Engineering confirmed by the IT Faculty Board 2015-06-25 (reference no. G 2015/365).

## **10. Other**

### **Credit transfer of former education**

In some cases, the student has the right to be given credit for former higher education according to the legislative regulations of the Higher Education Ordinance.

### **Evaluation**

The courses of the study programme are evaluated according to each course syllabus. The result will be used for planning and implementation of upcoming courses. A summary is given to students at the start of the courses.

The study programme will be followed up and evaluated in accordance with the applicable Policy för kvalitetssäkring och kvalitetsutveckling av utbildning vid Göteborgs universitet (Policy for the Quality Assurance and Quality Development of Education at the University of Gothenburg).