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The legally binding versions are found in the University of Innsbruck Bulletins (in German).

Original version published in the University of Innsbruck Bulletin of 11 May 2021, Issue 64, No. 749

Amendment published in the University of Innsbruck Bulletin of 4 August 2021, Issue 99, No. 961

Complete version as of 1 October 2021

Curriculum for the

Master's Programme Software Engineering

at the Faculty of Mathematics, Computer Science and Physics at the University of
Innsbruck

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§ 1 Allocation of the study programme

Acc. to §54 par. 1 Universities Act 2002, the Master's Programme in Software Engineering is grouped among the group of engineering studies.

§ 2 Qualification profile

- (1) Graduates of the master's programme have the necessary knowledge as well as the theoretical, methodological and practical skills and competencies to analyse complex tasks in the field of software engineering and to implement them in a targeted manner. The graduates are also able to critically question technologies, applications and scientific approaches in order to make well-founded, responsible decisions about their practical use. In addition, graduates have the competence to independently develop their knowledge and understanding in the field of software engineering. The master's programme is based on current scientific results in software engineering and provides the necessary knowledge for science and research-oriented occupations.
- (2) Graduates have in-depth knowledge of the methods and practices for the design, analysis, construction, testing, maintenance and operation of complex IT systems. In addition, in-depth technical and scientific knowledge in selected areas of software engineering is imparted. Graduates of the Master's Programme in Software Engineering are able to implement innovative and technically demanding software projects, work responsibly in interdisciplinary teams and act as an interface between specialist departments and development teams.
- (3) Due to their acquired qualifications, graduates can work in a wide range of professional fields in which they can take on positions with responsibility. These are in particular areas of responsibility with a focus on individual phases of the software life cycle as well as coordinating activities in the complex interaction between IT systems and organisations. Relevant roles are, for example, those of IT or system architects, product managers, software quality managers, those responsible for digitisation projects, IT consultants or IT entrepreneurs. The master's programme also provides knowledge and skills that enable persons to carry out highly qualified and independent research work within the scope of a continuing doctoral programme.
- (4) The master's programme is guided by reference to research in software engineering, data engineering, information security and IT management as well as practical issues. It is used for in-depth, practice-based and research-based pre-vocational training on the basis of a relevant bachelor's degree.

§ 3 Scope and duration

The Master's Programme Software Engineering covers 120 ECTS-Credits. This corresponds to a duration of four semesters. One ECTS-Credit corresponds to workload of 25 hours.

§ 4 Language of tuition

The Master's Programme Software Engineering is offered in English. In justified exceptional cases, exams and the Master's Thesis can be taken or written in German.

§ 5 Admission

- (1) Admission to the Master's Programme in Software Engineering requires a relevant Bachelor's degree awarded by a university or a university of applied sciences ("Fachhochschule") or a relevant degree acquired at a recognised post-secondary educational institution home or abroad.
- (2) In any case, the Bachelor's Programme in Computer Science or of the Supplementary Programme in Computer Science, which expands one of the following study programmes, is a relevant study programme:
 - Bachelor's Programme Management and Economics, Diploma Programme International Economic and Business Studies,
 - Bachelor's Programme Biology, Master's Programmes: Botany, Microbiology, Molecular Cell and Developmental Biology, Ecology and Biodiversity, Zoology,

- Bachelor’s Programme Chemistry, Bachelor’s Programme Pharmacy, Master’s Programmes: Chemistry, Chemical Engineering, Material and Nano Sciences, Pharmacy,
 - Bachelor’s Programme Atmospheric Sciences, Bachelor’s Programme Earth Sciences, Bachelor’s Programme in Geography, Master’s Programmes: Atmospheric Sciences, Earth Sciences, Geography: Global Change – Regional Sustainability, Environmental Meteorology,
 - Bachelor’s Programme in Physics, Bachelor’s Programme in Mathematics, Master’s Programme Erasmus Mundus Joint Master Programme in Astrophysics, Master’s Programme in Physics, Master’s Programme in Mathematics,
 - Bachelor’s Programme in Environmental Engineering, Bachelor’s Programme Electrical Engineering, Bachelor’s Programme in Mechatronics; Master’s Programme in Civil Engineering, Master’s Programme in Mechatronics, Master’s Programme in Environmental Engineering,
 - Bachelor’s Programme in Economy, Health and Sports Tourism, Master’s Programme Applied Economics.
- (3) The rectorate decides on study programmes in question or on the equivalence of a study programme passed at a post-secondary educational institution home or abroad for the admission to the master’s programme based on the regulations of the Universities Act 2002.
- (4) In the event that equivalence has been established in principle but with certain qualifications missing for full equivalence, supplemental examinations may be required by the rectorate. These examinations must be passed during the master's programme.

§ 6 Types of courses

- (1) Types of courses without continuous performance assessment:
Lectures (VO) are courses held in lecture format. They introduce the research areas, methods and schools of thought for a given subject. Maximum number of participants: no maximum number of participants
- (2) Courses with continuous performance assessment:
1. Introductory seminars (PS) introduce students interactively to scientific literature through the treatment of selected issues. They convey knowledge and methods of academic work. Maximum number of participants: 20
 2. Lectures with integrated practical parts (VU) focus on the practical treatment of concrete scientific tasks that are discussed during the lecture parts of the course. Maximum number of participants: 25
 3. Project studies (PJ) promote scientific collaboration of two or more fields through the treatment of multidisciplinary topics and the use of various methods and techniques. Maximum number of participants: 15
 4. Seminars (SE) provide in-depth treatment of scientific topics through students' presentations and discussion thereof. Maximum number of participants: 15

§ 7 Allocation of places in courses with a limited number of participants

In courses with a limited number of participants, course places are allocated as follows:

1. Students for whom the study duration would be extended due to the postponement are to be given priority.
2. If criterion no. 1 does not suffice for regulating the admission, then first, students for whom the course is part of a compulsory module are to be given priority, and second, students for whom the course is part of an elective module.
3. If the criteria in no. 1 and 2 do not suffice for regulating the admission, then the available places are raffled.

§ 8 Compulsory and elective modules

(1) The following compulsory modules covering altogether 62.5 ECTS-Credits must be passed:

1.	Compulsory Module: Software Engineering	h	ECTS-Credits
a.	VO Software Design and Software Development Processes	2	4.5
b.	PS Software Design and Software Development Processes	2	3
	Total	4	7.5
	Learning Outcomes: Analysis and modelling of modern software systems; selection and application of suitable processes, methods and tools for effective and efficient software development; conception and evaluation of complex software architectures; automation of development activities; knowledge and application of model engineering techniques		
	Prerequisites: none		

2.	Compulsory Module: Software Security Engineering	h	ECTS-Credits
a.	VO Introduction to Information Security and Privacy	2	4.5
b.	PS Introduction to Information Security and Privacy	2	3
	Total	4	7.5
	Learning Outcomes: Identification of potential security and critical privacy aspects of information technology systems; safe use of elementary terms; formulation of protection goals; understanding of simple cryptographic protocols based on abstract cryptographic functions; secure use of public key infrastructures; understanding of elementary concepts of data protection; first experiences in dealing with typical weak points of software systems; insights into social aspects of information security and data protection; awareness and assessment of one's own knowledge and skills in the security context		
	Prerequisites: none		

3.	Compulsory Module: Data Engineering and Analytics	h	ECTS-Credits
a.	VO Fundamentals of Data Engineering and Analytics	2	4.5
b.	PS Fundamentals of Data Engineering and Analytics	2	3
	Total	4	7.5
	Learning Outcomes: Basic understanding of data engineering and data analysis; knowledge and application of the dataset creation process, including collection, generation, cleansing, visualisation and validation; knowledge and application of the basics of feature extraction and the derivation of meaningful features; knowledge and application of selected methods of data analysis and machine learning; evaluation and assessment of data engineering and analytics processes		
	Prerequisites: none		

4.	Compulsory Module: Research Methods in Software Engineering	h	ECTS-Credits
a.	VO Research Methods and Science Communication in Software Engineering	2	3
b.	PS Research Methods and Science Communication in Software Engineering	2	4.5
	Total	4	7.5
	Learning Outcomes: Understanding of the theoretical principles of science; development and formulation of research questions for questions of software engineering; selection and application of suitable quantitative and qualitative research methods in software engineering; knowledge of the scientific publication process and implementation of systematic literature analyses; written and media preparation of the research process and the research results		
	Prerequisites: none		

5.	Compulsory Module: Advanced Topics in Software Engineering	h	ECTS-Credits
a.	VU Software Product Management	2	3
b.	VU Usability Engineering and Interaction Design	2	3
c.	VU Methods in Software Quality Assurance	2	4
	Total	6	10
	Learning Outcomes: Development and management of software variants; design and operation of software products; product lifecycle management; safe use of the basic concepts of usability engineering; collection and review of user requirements; design and evaluation of user interfaces; measurement of user experience; knowledge and application of advanced test procedures; knowledge and application of model-based quality assurance techniques; application of quantitative models in analytical and constructive quality assurance; quality assurance of modern software systems		
	Prerequisites: none		

6.	Compulsory Module: Software Engineering Project	h	ECTS-Credits
	PJ Software Engineering Project	2	10
	Total	2	10
	Learning Outcomes: Implementation of a practical application development project from conception to implementation and acceptance; selection and further application of software engineering methods and tools from the respective subject areas of the basic and advanced modules in the project context; achievement of extended project management competencies and improvement of soft skills through joint project work with team members who are differently specialised; target group-oriented preparation of project results		
	Prerequisites: none		

7.	Compulsory Module: Master's Thesis Seminar Software Engineering	h	ECTS-Credits
	SE Software Engineering	2	5
	Total	2	5
	Learning Outcomes: Independent familiarisation with advanced topics in software engineering; analysis and methodically correct processing of current research results; presentation and scientific communication of current research results		
	Prerequisites: positive evaluation of the compulsory modules Software Engineering and Research Methods in Software Engineering		

8.	Compulsory Module: Preparation of the Master's Thesis	h	ECTS-Credits
	SE Preparation of the Master's Thesis	2	5
	Total	2	5
	Learning Outcomes: Formulation of the research questions and development of the research design of the Master's Thesis		
	Prerequisites: positive evaluation of the compulsory modules Software Engineering and Research Methods in Software Engineering		

9.	Compulsory Module: Defence of the Master's Thesis	h	ECTS-Credits
	Final oral defence of the Master's Thesis in front of an examination board		2.5
	Total		2.5
	Learning Outcomes: Reflection on the Master's Thesis in the overall context of the study programme; The main focus lies the theoretical understanding, the methodological basics, conveying the results of the Master's Thesis and presentation skills.		
	Prerequisites: positive evaluation of all other compulsory and elective modules as well as the Master's Thesis		

(2) Elective modules covering altogether 40 ECTS-Credits must be passed as follows:

1. One of the two elective modules 1 or 2 must be passed.
2. Instead of elective modules covering 30 ECTS-Credits, a Minor may be passed, providing the availability of places. Minors (Complementary Subject Areas) are fixed modules from other disciplines covering 30 ECTS-Credits; They have been published in the University of Innsbruck Bulletin.

1.	Elective Module: Advanced Topics in Software Security Engineering	h	ECTS-Credits
a.	VU Construction and Operation of Secure Systems	3	5
b.	VU Secure Programming	3	5
	Total	6	10

	<p>Learning Outcomes: Knowledge of the correct configuration of the security settings and access control of software platforms (especially operating systems, web, cloud); use of proactive and reactive security measures and processes; knowledge of typical weak points in software systems; awareness of the susceptibility to errors in various programming languages and paradigms; skill in the correct use of cryptography libraries; experience in troubleshooting, testing and error prevention techniques</p>
	<p>Prerequisites: none</p>

2.	Elective Module: Advanced Topics in Data Engineering and Analytics	h	ECTS-Credits
a.	VU Advanced Data Management	3	5
b.	VU Advanced Data Engineering und Analytics	3	5
	Total	6	10
	<p>Learning Outcomes: Sound knowledge and application of modern data management and database concepts as well as big data management; knowledge of the internal structure of advanced database systems and the ability to use them in a targeted manner; knowledge and application of advanced methods and processes in data engineering and data analysis; application of methods of data analysis and machine learning in application areas as well as integration in data products</p>		
	<p>Prerequisites: none</p>		

3.	Elective Module: Current Topics in Software Engineering	h	ECTS-Credits
a.	VU Current Topics in Software Engineering 1:	3	5
b.	VU Current Topics in Software Engineering 2:	3	5
	Total	6	10
	<p>Learning Outcomes: Knowledge of current methods and techniques in software engineering</p>		
	<p>Prerequisites: none</p>		

4.	Elective Module: Interdisciplinary Skills	h	ECTS-Credits
	Providing the availability of places, courses covering 10 ECTS-Credits may be freely selected from the Master's and/or Diploma programmes offered at the University of Innsbruck.		10
	Total		10
	<p>Learning Outcomes: Expansion of the study programme by acquiring additional qualifications</p>		
	<p>Prerequisites: The prerequisites specified by the respective curricula must be met.</p>		

5. Individual Choice of Specialisation: (10 ECTS-Credits)

For individual specialisation, modules corresponding to 10 ECTS-Credits can be freely selected from the Master's programmes offered at the Faculties for Management, Biology, Chemistry and Pharmacy, Geo and Atmospheric Sciences, Mathematics, Computer Science and Physics, Engineering Sciences as well as Economics and Statistics. The prerequisites specified in the respective curricula must be met. It is recommended to pass a course in the field of Gender Studies, Women's and Gender Research.

§ 9 Master's Thesis

- (1) In the master's programme a Master's Thesis amounting to 17.5 ECTS-Credits must be written. The Master's Thesis is a scientific piece of work that proves the ability to work on a scientific topic relating to either compulsory module 1, 2, 3 or 5 independently and in a justifiable way in terms of content and methodology.
- (2) Students have the right to suggest the topic for their Master's Thesis or to select from a number of suggestions.

§ 10 Examination Regulations

- (1) Modules are evaluated by module examinations. Module examinations are examinations that proof the knowledge and skills acquired in a module. With successful completion of all parts of the module examination, the respective module is passed.
- (2) Courses of modules – with the exception of compulsory module 9 – are evaluated by course examinations. Course examinations are
 1. examinations that assess the knowledge and skills covered in the lectures in which course assessment is based on a single examination at the end of the course. The course instructor has to determinate the examination method (written or oral) before the start of the course.
 2. courses with continuous assessment, for which course assessment is based on regular written and/or oral contributions by participants.
- (3) Before the start of the courses, the course instructors have to inform the students in a suitable manner about the objectives, the content and the methods of their courses as well as the contents, the methods, the evaluation criteria and standards.
- (4) Compulsory module "Defence of the Master's Thesis" is evaluated by an oral exam before an examination board. The examination board consists of three persons.

§ 11 Academic degree

Graduates of the Master's Programme in Software Engineering are awarded the academic degree "Master of Science", abbreviated as "MSc".

§ 12 Coming into force

This curriculum comes into force as of 1 October 2021.