Note:

The following curriculum is a consolidated version. It is legally non-binding and for informational purposes only.

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Curriculum for the **Bachelor's Programme Computer Science** at the Faculty of Mathematics, Computer Science and Physics; University of Innsbruck

§ 1 Qualification profile

Computer science is concerned with foundations, technology and applications of systematic and automated information processing. Computer science delivers methods and tools to manage complex systems in natural sciences, technology and other areas of human life, applying mathematical-formal as well as engineering principles. On the other hand findings from natural science and technology flow into computer science and specific application problems can provide an impetus for further development of the basic principles. Accordingly fields of application and occupational areas of computer scientists are manifold ranging from foundational research to development, adaption and maintenance of specific hardware-, software- and networking solutions in different areas of trade, business and industry.

The diversity as well as the mathematical-formal and engineering components of computer science are clearly reflected in the educational concept of the University of Innsbruck, which increasingly promotes problem-oriented and project-oriented teamwork additional to traditional and established learning approaches. In addition to the skills and knowledge in the field of computer science, the Bachelor's Programme Computer Science prepares for the Master's Programme Computer Science. The study programme trains the ability to work scientifically and conveys the following key skills:

- fast familiarisation with new application areas,
- problem analysis and creative problem solving,
- abstraction and formalisation,
- presentation and documentation of the developed solutions,
- work in interdisciplinary teams,
- project management,
- working and handling of new media, information services and communication tools.

The bachelor's programme provides solid and scientific education in the core areas of computer science and the application of the subject matter to specific problems. The entwined education enables graduates to

- specify hardware, software or network systems in an autonomous manner and in accordance with customers from all application areas and with regard to company connections,
- be able to evaluate the available components on the market or in the company content-related and commercially,
- be able to develop complex systems according to the desired specifications from existing components and components yet to be developed,
- be able to independently develop the necessary new components by using appropriate development environments and methods,
- work in development teams (with English as working language) and to lead smaller projects and development teams and
- introduce developed solutions in the respective context in a responsible manner and to be able to give appropriate employee trainings.

Overall, graduates of the bachelor's programme are able, after a short introductory period, to actively take part in the development and realization of innovative and complex hardware, software or network systems in companies and institutions.

§ 2 Allocation

The Bachelor's Programme Computer Science is grouped among the engineering sciences.

§ 3 Scope and duration

The Bachelor's Programme Computer Science covers 180 ECTS-Credits, with a duration of six semesters. Compulsory modules, amounting to 155 ECTC-Credits and elective modules, amounting to 25 ECTS-Credits, are to be taken.

§ 4 Types of courses and maximum number of participants

(1) **Lecture (VO)**

Lectures introduce, in a didactically well-designed manner, central concepts, results and methods of the respective subject.

Purpose: raise interest and to facilitate well-structured knowledge and basic understanding of a subject in a relatively short period of time.

(2) **Introductory seminar (PS)**

Introductory seminars are usually linked to a lecture. The students are assigned tasks and the solutions thereof are discussed in the introductory seminar. If the introductory seminar is linked to a lecture, the content of the lecture is repeated and exercises are carried out.

Purpose: Training to solve problems independently, exercise in working methodically, exercise in presenting professional contents and scientific deepening of learned contents.

Course with continuous assessment; the maximum number of participants for each introductory course are mentioned in § 5.

(3) **Seminar (SE)**

A seminar serves the scientific examination of contents and methods of a subject through presentations, written assignments and discussions. Students learn written (assignment) and oral

(seminar presentation) and demonstration of scientific findings. In seminars with bachelor's thesis, the written assignment is replaced by the bachelor's thesis.

Course with continuous assessment; maximum number of participants: 15

(4) **Study orientation course (SL)**

The study orientation course conveys an overview on the main contents of the study programme, and it forms the basis for the decision to choose the study programme. Attendance in the study orientation course is compulsory. Maximum number of participants: 30.

§ 5 Modules (Title, Type, Description, Course Content)

(1) Compulsory modules

1. *Introduction to Programming*			7.5 ECTS- Credits
Objective			
Students understand the most important concepts of practical informatics and can apply them. They are able to use system software and programming tools. Moreover, they can analyse elementary algorithms and data structures and apply them.			
VO3	Introduction to Programming		4.5 ECTS- Credits
Contents			
Introduction to imperative computer programming; introduction to C; data types; variables; instructions; functions; arrays; pointer; modularization; implementation of elementary algorithms and data structures.			
PS2	Introduction to Programming	max. no. 30	3 ECTS- Credits
Contents			
Profound discussion of concepts and tools taught in the lecture, based on weekly programming assignments.			

2. *Introduction to Practical Computer Science*			5 ECTS- Credits
Objective			
Students learn the most important concepts of Imperative programming and can apply them. They have acquired the ability to create similar contents for themselves and are able to analyse, plan and create programmes of their own.			
VO2	Introduction to Practical Computer Science		3 ECTS- Credits
Contents			
General practical foundations; data and representation; methodical foundations of programming languages; elementary algorithms; elementary data structures; basics of system software.			
SL1	Introduction to Practical Computer Science	max. no. 30	2 ECTS- Credits
Contents			
Introduction on using modern computer systems, discussion, practising the lecture contents using practical exercises.			

3. *Introduction to Technical Computer Science*			5 ECTS- Credits
Objective			
Students understand the main concepts of computer organization and can apply them. They understand the architectural forms of modern computers and are able to construct programmes in assemblers and to evaluate modern computer systems.			
VO2	Introduction to Technical Computer Science		3 ECTS- Credits
Contents			
The objective of this course is gain first insights into the field of computer engineering. We study the fundamentals of digital computers, concepts of digital circuits, computer arithmetic, and microprocessor systems. In the scope of the course, we discuss all selected topics in more details; and we investigate new aspects such as assembly programming.			
PS1	Introduction to Technical Computer Science	max. no. 30	2 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; exercise scientific argumentation and presentation of topics related to computer engineering.			

4. *Introduction to Theoretical Computer Science*			5 ECTS- Credits
Objective			
Students understand the concept of calculability and various formal calculating models as well as their differences. Moreover, they can reduce information to the basics and represent it abstractly as well keeping formal proof.			
VO2	Introduction to Theoretical Computer Science		3 ECTS- Credits
Contents			
Propositional logic, circuits, grammars, Chomsky-hierarchy, formal models, computability, equational logic, programme verification.			
PS1	Introduction to Theoretical Computer Science	max. no. 30	2 ECTS- Credits
Contents			
Discussion, practice the topics of the lecture, practice scientific argumentation and present topics of theoretical computer science.			

5. *Linear Algebra*		7.5 ECTS- Credits
Objective		
Students can understand the contents of the lecture and can repeat and apply them. They are familiar with the formulae and writing systems of linear algebra. They can solve problems in the area of linear algebra with algorithms and they can formulate for themselves variants of algorithms to fit the situation. They can reduce information to its basics and convert problems to equivalent but easier to solve forms.		
VO3	Linear Algebra	4.5 ECTS- Credits
Contents		
Matrices; systems of linear equations; vector spaces; vector spaces with a scalar product (introduction to Euclidean geometry); computations with functions; Eigenvalue problems.		

PS2	Linear Algebra	max. no. 30	3 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of mathematical topics.			

6. *Algorithms and Data Structures*			7.5 ECTS- Credits
Objective			
Students know and understand important algorithms and data structures and are able to create further algorithms on their own and to use them in their own programmes. They also understand the complexity of the various algorithms.			
VO3	Algorithms and Data Structures		4.5 ECTS- Credits
Contents			
Analysis, complexity quantification and implementation of algorithms: to sort, search in quantities, in trees and graphs; characteristics of efficient algorithms and related data structure.			
PS2	Algorithms and Data Structures	max. no. 30	3 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of computer science topics.			

7. *Operating Systems*			7.5 ECTS- Credits
Objective			
Students understand the main concepts of the process, storage files and administration section of the operating system and can apply these. Moreover, they are able to analyse operating system resources and to create and implement creative solutions for their use.			
VO3	Operating Systems		4.5 ECTS-Credits
Contents			
Types of operating systems; programme, memory, and device management; processes; process synchronization; threads; process scheduling; deadlocks; virtualization concepts; security concepts; operating system case studies.			
PS2	Operating Systems	max. no. 30	3 ECTS-Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of computer science topics; programming at operating system level.			

8. *Discrete Mathematics*			7.5 ECTS- Credits
Objective			
Students know various methods of proof. They understand formal techniques and elementary methods of analysis of discrete structures and can represent information abstractly.			
VO3	Discrete Mathematics		4.5 ECTS- Credits
Contents			
Proof methods; whole and rational numbers; introduction to graph theory; elementary counting theory; discrete probability calculation; finite automata; Turing machines; fundamentals of complexity theory.			
PS2	Discrete Mathematics	max. no. 30	3 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of formal contents.			

9. *Programming Methodology*			7.5 ECTS- Credits
Objective			
Students understand the concepts of object-oriented programming and can apply them. They have learnt how to work out similar contents for themselves. They are able to analyse object-oriented programmes and to plan and build their own object-oriented programmes.			
VO3	Programming Methodology		4.5 ECTS- Credits
Contents			
Introduction to object-oriented programming; classes, objects, and methods; inheritance; polymorphism; exception handling; generic programming; object-oriented design; GUI programming.			
PS2	Programming Methodology	max. no. 30	3 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture with practical programming exercises.			

10. *Analysis*			5 ECTS- Credits
Objective			
Students understand the content of the lecture and can repeat it and apply it. They are familiar with the formulae and writing systems of analysis and have acquired the ability to work out similar contents for themselves. Moreover, with the help of differential and integers calculations they can construct simple models and test them either analytically or numerically.			
VO2	Analysis		3 ECTS- Credits
Contents			
Reel figures; elementary functions; differential and integers calculations modelling.			
PS1	Analysis	max. no. 25	2 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of mathematical contents.			

11. *Database Systems*			7.5 ECTS- Credits
Objective			
Students know and understand concepts of data bank systems and can apply them. Moreover, they can carry out data modelling on a logical, conceptual and physical level and to formulate retrievals on these models.			
VO3	Database Systems		4.5 ECTS- Credits
Contents			
Entity-Relationship-Model; foundations of relational database systems; relational query languages; normal forms; physical data organisation; internal structure of database systems; object-relational database systems; current approaches.			
PS2	Database Systems	max. no. 25	3 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation; practical exercises of database systems, in particular SQL and extensions.			

12. *Design of Software Systems*			5 ECTS- Credits
Objective			
Students know and understand the methods and techniques for planning software systems and they can apply them. Moreover, they are able to analyse problems of software planning and to find appropriate solutions. They have acquired the ability to work out similar contents themselves.			
VO2	Design of Software Systems		3 ECTS- Credits
Contents			
Event-based programming, design patterns, component-based design, concurrency, client-server programming, meta modelling.			
PS1	Design of Software Systems	max. no. 25	2 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in presentation of software systems by using notations of software design.			

13. *Functional Programming*			5 ECTS- Credits
Objective			
Students understand the differences between imperative and functional programming as well their respective advantages and disadvantages. They know the main concepts of functional programming. Moreover, they learn how to demonstrate the qualities of functional programming.			
VO2	Functional Programming		3 ECTS- Credits
Contents			
Introduction to functional programming; data structures and algorithms; computation and proving; recursion and higher-order functions; implementation of functional programming languages; type concepts and type systems.			
PS1	Functional Programming	max. no. 25	2 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture with functional programming language; practice in functional programming.			

14. *Logic*			7.5 ECTS- Credits
Objective			
Students understand logical calculus and can apply it. They have learnt how to create similar contents for themselves. They are able to abstract and model complex problems into formal calculi.			
VO3	Logic		4.5 ECTS- Credits
Contents			
Propositional logic; predicate logic; introduction to proof systems; natural deduction for propositional and predicate logic; binary decision diagrams; introduction to verification and model checking.			
PS2	Logic	max. no. 25	3 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of formal contents.			

15. *Computer Graphics*			5 ECTS- Credits
Objective			
Students can understand the elementary methods of computer graphics. They can model real or virtual scenes for themselves and can also abstract complex problems and model them into formal calculi.			
VO2	Computer Graphics		3 ECTS- Credits
Contents			
3D graphic programming with OpenGL; geometric modelling; view transformation; lighting and texturing; OpenGL Shading Language; hierarchical modelling with scene graphs.			
PS1	Computer Graphics	max. no. 25	2 ECTS- Credits
Contents			
Specialisation and practice of the topics covered in the lecture, in particular OpenGL programming.			

16. *Introduction to Autonomous and Intelligent Systems*			5 ECTS- Credits
Objective			
Students can understand important problems of building autonomous systems, particularly in the areas of visual perception, learning and kinematics. They have acquired the ability to formalise and theoretically to solve with the tools of visual geometry simple problems of enhancement learning and kinematics and to create similar contents on their own. Moreover, they can implement appropriate algorithms into software.			
VO2	Introduction to Autonomous and Intelligent Systems		3 ECTS- Credits
Contents			
Design of artificial autonomous systems: image processing, in particular visual geometry; machine learning, in particular reinforcement learning; robotics, in particular kinematics and regulation.			
PS1	Introduction to Autonomous and Intelligent Systems	max. no. 25	2 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture with theoretical brainteasers and arithmetic problems as well as practical programming exercises.			

17. *Introduction to Scientific Working*			2.5 ECTS- Credits
Objective			
Students completing this module understand the main concepts and methods of scientific work and can apply them. They have learned how to write scientific texts and scientific work.			
PS2	Introduction to Scientific Working	max. no. 25	2.5 ECTS- Credits
Contents			
Introduction to the fundamental principles of scientific working: requirements of scientific working; technical writing; evaluation of scientific works; presentation techniques; developing, writing and design of scientific works with $\LaTeX$; practice in presenting scientific works.			

18. *Computer Networks and Internet Technology*			7.5 ECTS- Credits
Objective Students understand the main concepts of computer networks and of internet technology and they know how to apply them. They have learned how to produce similar content for themselves. They can analyse technical problems of the network and solve these problems with technical programmes.			
VO3	Computer Networks and Internet Technology		4.5 ECTS- Credits
Contents Layer models; methods of application layers; end-to-end transmission of the transport layer (incl. error handling and overload protection); routing and forwarding at the network layer; data link layer; physical layer; comprehensive aspects of the quality of service and network security.			
PS2	Computer Networks and Internet Technology	max. no. 25	3 ECTS- Credits
Contents Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of computer science contents; network programming.			

19. *Software Engineering and Project Management*			10 ECTS- Credits
Objective			
Students understand software development- and project management techniques and methods and can apply them. Moreover, they can analyse problems from a software development perspective and can create software solutions. They have acquired these competences through teamwork.			
VO3	Software Engineering and Project Management		3 ECTS- Credits
Contents			
Quality assurance; modelling techniques and design processes; project management in software projects; project initialization and planning; controlling in projects; project closure and reflection.			
PS3	Software Engineering and Project Management	max. no. 25	7 ECTS- Credits
Contents			
Implementation of a semester project in a team using the techniques and methods covered in the lecture, as well as tools of software development; discussion and practice of communication techniques in the team and with users, presentation of results in oral and written form.			

20. *Specialisation Seminar*		2.5 ECTS- Credits
Objective		
Students can deal with an area of informatics methodologically correctly and present the results of their encounter both orally and in writing.		
SE1	Specialisation Seminar	2.5 ECTS- Credits
Contents		
Deep analysis of one branch of computer science; preparation of talk and seminar work, which goes beyond the content which is addressed in the remaining curriculum.		

21. *Distributed Systems*			5 ECTS- Credits
Objective			
Students understand the concepts, architectural principals, organizational and communicational forms of modern distributed systems and they can also apply them. In addition they are able to localize problems of distributed systems and to analyse them as well as producing creative solutions.			
VO2	Distributed Systems		3 ECTS- Credits
Contents			
Distributed object systems; synchronization; error tolerance; name services; communication in distributed systems; centralised and decentralised architectures; communication mechanisms; name systems; synchronisation; replications and consistency; object, web, and coordination-based distributed systems.			
PS1	Distributed Systems	max. no. 25	2 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of computer science contents.			

22. *Seminar with Bachelor Thesis*			20 ECTS- Credits
Objective			
Students can deal with a section of informatics methodologically correctly and present the results of their encounter both orally and in writing.			
SE1	Seminar with Bachelor Thesis		20 ECTS- Credits
Contents			
Acquisition of advanced concepts in a subarea of computer science; independent preparation of a Bachelor thesis and an oral presentation.			

23. *Interdisciplinary Skills*	7.5 ECTS- Credits
Lectures of up to 7.5 ECTS-Credits from other bachelor's programmes set up at University of Innsbruck can be chosen freely. It is recommended to attend teaching units on the topic of the gender aspects of mathematics, informatics and physics. In addition to wide your professional education, and to acquire key qualifications, it is advisable to attend relevant teaching units of other study areas, for example to deepen your knowledge of the English language and to get to know various areas of application of informatics. In particular, those students who want to specialize in an area of application after their bachelor's degree have the opportunity to acquire basic knowledge in a suitable subject.	
Objective	
Students possess additional competences and skills from other scientific disciplines.	
Prerequisites	
The prerequisites of the respective curricula do apply.	

(2) Elective modules

Five elective modules from 1 – 14, amounting to 25 ECTS-Credits, are to be taken.

1. *Architecture and Implementation of Database Systems*			5 ECTS- Credits
Objective			
Students know and understand the methods and techniques for planning and implementing data banks and they can apply them. In particular they can develop systems for efficient data storage and data retrieval.			
VO1	Architecture and Implementation of Database Systems		2 ECTS- Credits
Contents			
Practical design and implementation of a database; increase in theoretical background knowledge; concrete approaches to solutions for physical data storage, index structures, transactions, recovery, deadlock concepts and query optimization.			
PS2	Architecture and Implementation of Database Systems	max. no. 25	3 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of computer science contents; practice in implementation of database systems.			

2. *Introduction to Computer Vision*			5 ECTS- Credits
Objective			
Students understand elementary methods of picture processing and of understanding pictures; they are able to ensuing problems with the targeted use of these methods and can create similar content for themselves.			
VO2	Introduction to Computer Vision		3 ECTS- Credits
Contents			
Image formation, image features, object recognition, stereopsis, motion, structure from motion, biological inspiration/plausibility.			
PS1	Introduction to Computer Vision	max. no. 25	2 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture with theoretical brainteasers and arithmetic problems as well as practical programming exercises.			

3. *Introduction to Parallel Computing and Parallel Algorithms*			5 ECTS- Credits
Objective			
Students know the concepts and methods if parallel calculation and can use these with real programmes. Moreover, they have knowledge of selected parallel algorithms and can use these independently with practical examples. They have learned how to analyse problems to process new algorithm on their own and to implement and accelerate modern parallel computers.			
VO2	Introduction to Parallel Computing and Parallel Algorithms		3 ECTS- Credits
Contents			
Parallel programming models; message passing computing; design of parallel algorithms; parallelization strategies; data parallelism; task parallelism; selected parallel algorithms.			
PS1	Introduction to Parallel Computing and Parallel Algorithms	max. no. 25	2 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of computer science contents.			

4. *Introduction to Machine Learning*			5 ECTS- Credits
Objective			
Students have an overview of elementary methods of machine learning. They have acquired the ability to formalize specific problems and to solve them with the targeted use of methods they have learned. Moreover, they are able to work on similar content for themselves and they can also implement suitable algorithms in software.			
VO2	Introduction to Machine Learning		3 ECTS- Credits
Contents			
Introduction to elementary methods of machine learning; overview of probability theory; fundamentals in regression and classification; unsupervised learning.			
PS1	Introduction to Machine Learning	max. no. 25	2 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture with theoretical brainteasers and arithmetic problems as well as practical programming exercises.			

5. *Information Theory and Cryptology*			5 ECTS- Credits
Objective			
Students completing this module understand the elementary methods of information theory and cryptology. They have acquired the ability to formalize specific problems by codifying or by crypto systems and through the use of the methods learnt. Moreover, they are able to produce similar content by themselves.			
VO2	Information Theory and Cryptology		3 ECTS- Credits
Contents			
Randomized algorithms; pseudo random generators; entropy of information sources; redundancy of natural languages; lossless data compression; symmetric cryptosystems; secure sharing of secrets; public key cryptosystems; digital signatures and cryptographic hash functions.			
PS1	Information Theory and Cryptology	max. no. 25	2 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of formal contents.			

6. *Artificial Intelligence*			5 ECTS- Credits
Objective			
Students have a comprehensive overview of the most important topics and artificial intelligence they know and understand various methods and techniques for constructing intelligence systems and they can also apply them.			
VO2	Artificial Intelligence		3 ECTS- Credits
Contents			
Basic topics of artificial intelligence; Problem solving and search strategies, information and data representation, machine learning, planning, and logical reasoning.			
PS1	Artificial Intelligence	max. no. 25	2 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of computer science contents.			

7. *Logic Programming*			5 ECTS- Credits
Objective			
Students know the most important concepts of logical programming and they can arrange already known programming paradigms and know their strengths and weaknesses.			
VO2	Logic Programming		3 ECTS- Credits
Contents			
Syntax and semantics of logic programmes; unification and resolution; duality and non-determinism in logic programming; Prolog; negation and cut; extra-logic predicates.			
PS1	Logic Programming	max. no. 25	2 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture with the programming language Prolog; practice in logical programming.			

8. *Concurrent Programming*			5 ECTS- Credits
Objective			
Students have mastered the methods and techniques of programming multi-core processors and also the most important concepts of concurrent programming and they can apply these. Moreover, they can also analyse problems work out creative concurrent solutions and apply them in software.			
VO2	Concurrent Programming		3 ECTS- Credits
Contents			
Programming of multi-core processors; concurrent programming; thread parallelism; communication and synchronization; thread safety; concurrent data structures; performance and scalability; model-based design; libraries and frameworks.			
PS1	Concurrent Programming	max. no. 25	2 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of computer science contents.			

9. *Programming of Sensor Networks*			5 ECTS- Credits
Objective			
Students understand the most important concepts of sensor networks and can apply them. They have learned to create similar contents for themselves. They understand the workings of sensor networks and know how to produce programmes for embedded systems.			
VO1	Programming of Sensor Networks		1.5 ECTS- Credits
Contents			
Basic concepts; sensor networks; hardware characteristics; energy limitations; media access; routing; localisation; programming methods.			
PS2	Programming of Sensor Networks	max. no. 25	3.5 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of computer science contents; practice in programming of sensor nodes.			

10. *Programming of Web Information Systems*			5 ECTS- Credits
Objective Students know and understand the methods and techniques for drafting and implementing web-based information systems and they can also apply them. Moreover, they are able to analyse the requirements of web-based information systems and to find creative solutions for them working in teams.			
VO1	Programming of Web Information Systems		2 ECTS- Credits
Contents Introduction to web programming; use of script languages and other web technologies; practical design and implementation of web information systems.			
PS2	Programming of Web Information Systems	max. no. 25	3 ECTS- Credits
Contents Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of computer science contents; practice in implementing web information systems.			

11. *Process Modelling*			5 ECTS- Credits
Objective			
Students possess competences in the area of process modelling. They can analyse business processes and present these as process models. Moreover, they can also judge the quality of process models and analyse them critically. They learn how to work in teams.			
VO2	Process Modelling		3 ECTS- Credits
Contents			
Scenarios of process modelling; quality of process models (e.g. comprehension and maintainability); metrics for process models; techniques for process models (e.g. feasibility, transformation, similarity calculation).			
PS1	Process Modelling	max. no. 25	2 ECTS- Credits
Contents			
The topics of the lecture Process Modelling are covered in-depth by investigating practical problems.			

12. *Software Quality*			5 ECTS- Credits
Objective			
Students know and understand the methods and techniques of quality control and can apply these in software projects. They can identify quality problems in software projects and select suitable techniques for their solution. They also learned how to produce similar content for themselves.			
VO2	Software Quality		3 ECTS- Credits
Contents			
Basic concepts; constructive quality assurance (e.g.: programming guidelines); statistical analysis; software testing; software metrics; software infrastructure (e.g.: version management); formal verification methods; software processes.			
PS1	Software Quality	max. no. 25	2 ECTS- Credits
Contents			
Discussion and practice of the topics covered in the lecture with practical issues.			

13. *Term Rewriting*			5 ECTS- Credits
Objective Students understand the concepts of Term Rewriting as a formal calculation model which provides the basis for functional programming. Moreover, they also learned the main qualities of Term Rewriting systems together with methods to prove their qualities.			
VO2	Term Rewriting		3 ECTS- Credits
Contents Abstract rewrite systems; equational logic; term rewrite systems and their properties; termination; confluence; completion; strategies.			
PS1	Term Rewriting	max. no. 25	2 ECTS- Credits
Contents Discussion and practice of the topics covered in the lecture with theoretical brainteasers and arithmetic problems.			

14. *Web Services*			5 ECTS- Credits
Objective			
Students know and understand the most important concepts, challenges and possibilities of the availability of online services with the help of Web Services. They know and understand the standards and techniques they embody and they have learned for themselves how to deal with similar and newly developing technologies.			
VO1	Web Services		2 ECTS- Credits
Contents			
Web service technologies; standards and methods (e.g. XML, SOAP, WSDL, REST, WS-* specifications); web service use cases.			
PS2	Web Services	max. no. 25	3 ECTS-Credits
Contents			
Discussion and practice of the topics covered in the lecture; practice in scientific argumentation and presentation of computer science contents.			

§ 6 Studies Induction and Orientation Stage

(1) Within the scope of the Studies Induction and Orientation Stage, which takes place in the first semester, the following course examinations must be passed:

1. VO Introduction to Programming (CM 1/3 h/4,5 ECTS-AP,
2. VO Introduction to Practical Computer Science (CM 2/2 hrs./3 ECTS-Credits),
3. SL Introduction to Practical Computer Science (CM 2/1 h/2 ECTS-Credits).

(2) Successful passing of all exams of the Studies Induction and Orientation Stage entitles to passing all further courses and examinations as well as to writing the Bachelor's Thesis.

(3) Before successful completion of the Studies Induction and Orientation Stage courses amounting to 20,5 ECTS-Credits may be passed. The requirements specified in the curriculum must be met.

§ 7 Bachelor's Thesis

A Bachelor's Thesis, amounting to 20 ECTS-Credits, is to be completed within one semester. The Bachelor's Thesis is to be presented in the seminar and submitted in paper form and in digital version to the lecturer of the seminar. The form of the submission of the digital version is to be determined by the Director of Studies.

§ 8 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 the criteria in Z 1 do not suffice, first, students for whom this course is part of a compulsory module are to be given priority, and second, students for whom this course is part of an elective module.
3. If the criteria in Z 1 and 2 do not suffice, the available places are drawn by random.

§ 9 Examination regulations

(1) For each lecture of a compulsory or elective module, an examination is to be taken. The instructor announces the type of examination (written or oral) before the start of the course.

(2) For each study orientation course, an examination is to be taken. The instructor announces the type of examination (written or oral) before the start of the course.

(3) In seminars, the success of participation, a presentation and a written assignment are assessed. If the bachelor's thesis is completed within the context of a seminar, the written bachelor's thesis and its presentation are evaluated within the context of a seminar presentation.

(4) The methods of evaluation in all other continuous assessment courses (‚immanent examination') are to be defined by the instructor before the start of the course.

(5) A module is completed when all of its courses have been successfully completed.

§ 10 Academic degree

Graduates of the Bachelor's Programme Computer Science are awarded the academic degree "Bachelor of Science", abbreviated "BSc".

§ 11 Coming into force

(1) The curriculum is effective as of 1 October 2007.

(2) Modification of the curriculum published in the University of Innsbruck Bulletin of 23 June 2010, Issue 42, No 330 is effective as of 1 October 2010 and applies to all students.

(3) §§ 1, 3, 5, 7 and 9 in the version published in the University of Innsbruck Bulletin of 16 June 2011, Issue 31, No 482 is effective as of 1 October 2011 and applies to all students.

(4) § 6 in the version published in the University of Innsbruck Bulletin of 16 June 2011, Issue 31, No 482 is effective as of 1 October 2011 and applies to all students beginning their degree programme as of winter semester 2011/2012.

(5) § 6 in the version published in the University of Innsbruck Bulletin of 16 June 2011, Issue 31, No 482 ceases to be effective at the end of 30 September 2014.

(6) § 6 in the version of the University of Innsbruck Bulletin of 2 May 2016, Issue 24, No. 376 comes into force on 1 October 2016 and is to be applied to all students commencing the Bachelor's Programme Computer Science as of the 2016/2017 winter semester.

§ 12 Transitory provisions

(1) Regular students who have commenced the Bachelor's Programme Computer Science at the University of Innsbruck before 1 October 2007 are entitled from this point in time onwards to complete this study within a maximum of seven semesters.

(2) If the Bachelor's Programme Computer Science is not completed within the specified time then this curriculum of the bachelor's programme will apply.

(3) Students of the Bachelor's Programme Computer Science are entitled to change to this curriculum of the bachelor's programme at any time on a voluntary basis.

(4) The recognition of exams according to § 78 Para. 1 University Organisation Act 2002 is set out in appendix 1 of this curriculum.

(5) The course examinations according to the curriculum for the Bachelor's Programme Computer Science in the version of the University of Innsbruck Bulletin from 23 April 2007, issue 30, no. 194, correspond to the respective course examinations of the curriculum in the version of the University of Innsbruck Bulletin from 23 June 2010, issue 42, no. 330, as follows:

Curriculum 2007	**Curriculum 2010**
VO 2 Digital Signal Processing	VO 2 Process Modelling
PS 1 Digital Signal Processing	PS 1 Process Modelling
VO 3 Multimedia Systems	VO 2 Software Architectures and Enterprise Systems PS 1 Software Architectures and Enterprise Systems

(6) The course examinations according to the curriculum for the Bachelor's Programme Computer Science in the version of the University of Innsbruck Bulletin from 23 June 2010, issue 42, no. 330, correspond to the respective course examinations of the curriculum in the version of the University of Innsbruck Bulletin from 16 June 2011, issue 31, No. 482, as follows:

Curriculum 2007 und 2010	**ECTS-Credits**		**Curriculum 2011**	**ECTS-Credits**	
Architecture and Implementation of Database Systems	VO 3	5	Architecture and Implementation of Database Systems	VO 1 PS 2	2 3
Operating Systems	VO 2	3	Operating Systems	VO 3	4.5
Operating Systems	PS 1	2	Operating Systems	PS 2	3
Compiler Construction	VO 1 PS 1	1 1.5	*Interdisciplinary Skills*		2.5
Database Systems	PS 1	3	Database Systems	PS 2	3
Introduction to Scientific Working	VO 1 PS 1	1.5 1	Introduction to Scientific Working	PS 2	2.5
Introduction to Computer Science	VO 3	4.5	Introduction to Programming Introduction to Practical Computer Science 3	VO 3 VO 2	4.5 3
Introduction to Computer Science	PS 2	3	Introduction to Programming Introduction to Practical Computer Science 2	PS 2 SL 1	3 2
Introduction to Mathematics 1	VO 3	4.5	Linear Algebra	VO 3	4.5
Introduction to Mathematics 1	PS 2 PR 1	2.5 0.5	Linear Algebra	PS 2	3
Introduction to Mathematics 2	VO 3	4.5	Analysis	VO 2 PS 1	3 2
Introduction to Mathematics 2	PS 2 PR 1	2.5 0.5	Analysis	PS 1	2
Introduction to Physics	VO 5	7.5	Introduction to Autonomous and Intelligent Systems	VO 2 PS 1	3 2
Formal Language and Automata Theory	VO 3	4.5	Introduction to Theoretical Computer Science 3	VO 2	3
Formal Language and Automata Theory	PS 2	3	Introduction to Theoretical Computer Science 2	PS 1	2
Hardware-related Programming	VO 2	3	Programming of Sensor Networks	VO 1	1.5
Hardware-related Programming	PS 1	2	Programming of Sensor Networks	PS 2	3.5
Intelligent Systems	VO 2	3	Artificial Intelligence	VO 2	3
Intelligent Systems	PS 1	2	Artificial Intelligence	PS 1	2
Human-Computer Interaction	VO 2	5	Introduction to Computer Vision	VO 2 PS 1	3 2
Programming Methodology	PS 1	3	Programming Methodology	PS 2	3

Programming Laboratory	PS 1	5	Programming of Web Information Systems	VO 1 PS 2	2 3
Computer Architecture	VO 3	4.5	Introduction to Technical Computer Science 3	VO 2	
Computer Architecture	PS 1	3	Introduction to Technical Computer Science 2	PS 1	
Computer Networks	VO 2	3	Computer Networks and Internet Technology 4.5	VO 3	
Computer Networks	PS 1	2	Computer Networks and Internet Technology 3	PS 2	
Cyberlaw	VO 2	2.5	*Interdisciplinary Skills*		2.5
Software Architectures and Enterprise Systems	VO 2	3	Software Quality	VO 2	3
Software Architectures and Enterprise Systems	PS 1	2	Software Quality	PS 1	2
Technology, Humans and Society	VO 1 PS 1	1.5 1	*Interdisciplinary Skills*		2.5
Seminar with Bachelor Thesis	SE 2	20	Seminar with Bachelor Thesis	SE 1	20
Term Rewriting	VO 3	5	Term Rewriting	VO 2 PS 1	3 2
Specialisation Seminar	SE 2	2.5	Specialisation Seminar	SE 1	2.5
Probability and Information Theory	VO 2	3	Information Theory and Cryptology	VO 2	3
Probability and Information Theory	PS 1	2	Information Theory and Cryptology	PS 1	2

Appendix 1: Recognition of Exams

The following positively assessed exams, taken as part of the Bachelor's Programme Computer Science (curriculum from 3 September 2001) or another study at the University of Innsbruck will be recognised as equal towards the Bachelor's Programme Computer Science according to § 78 Par. 1 University Organisation Act 2002 as follows:

Exams successfully completed:		**Recognised as:**	
Software Development 1	VO2	Introduction to Computer Science	VO3
Software Development 1	UE3	Introduction to Computer Science	PS2
Software Development 2	VO2	Programming Methodology	VO3
Software Development 2	UE3	Programming Methodology	PS1
Software Development 3	VO2	Design of Software Systems	VO2
Software Development 3	UE3	Design of Software Systems	PS1
Software Development 4	VO2	Software Development and Project Management	VO3
Software Development 4 Teamwork and Project Organization	UE3 VU2	Software Development and Project Management	PS3
Formal Methods 1	VO3 UE2	Discrete Mathematics	VO3 PS2
Technological Foundations	VO2 UE2	Introduction to Physics	VO5
Algorithms and Data Structures	VO2 UE2	Algorithms and Data Structures	VO3 PS2
Algorithmic Mathematics 1	VO3	Introduction to Mathematics 1	VO3
Algorithmic Mathematics 1	UE2	Introduction to Mathematics 1	PS2 PR1
Algorithmic Mathematics 2	VO3	Introduction to Mathematics 2	VO3
Algorithmic Mathematics 2	UE2	Introduction to Mathematics 2	PS2 PR1
Algorithmic Mathematics 5	VO2	Computer Graphics	VO2
Algorithmic Mathematics 5	UE1	Computer Graphics	PS1
Algorithmic Mathematics 6	VO2 UE1	Probability and Information Theory	VO2 PS1
Algorithmic Mathematics 7	VO2 UE1	Logic	VO3 PS2
Database and Information Systems	VO3 UE2	Database Systems	VO3 PS1
Computer Architecture	VO2 UE2	Computer Architecture	VO3 PS1
Presenting and Moderating	VU2	Introduction to Scientific Working	VO1 PS1
Cyberlaw	VO2	Cyberlaw	VO2
Operating Systems	VO2	Operating Systems	VO2
Operating Systems	UE2	Operating Systems	PS1

Computer Networks	VO2 UE2	Computer Networks	VO2 PS1
Computer Science in Economy, Science and Society	VO2 UE1	Human-Computer Interaction	VO1 PS1
Project Internship 1 Project Internship 2	PR8 PR8	Seminar with Bachelor Thesis	SE2
Seminar	SE2	Specialisation Seminar	SE2

Exams covering all other courses in compulsory or elective modules of the Bachelor's Programme Computer Science (curriculum from 3 September 2001) will be recognised with the same amount of ECTS-Credits as exams of courses of the elective module with the additional elective module 'Bachelor Computer Science'.

The following positively assessed exams, taken as part of the „Magister" Programme Computer Science (curriculum from 3 September 2001) or another study at the University of Innsbruck will be recognised as equal towards the Bachelor's Programme Computer Science at the University of Innsbruck according to § 78 Par. 1 University Organisation Act 2002 as follows:

Exams successfully completed:		**Recognised as:**	
Compiler and Formal Languages	VO2 UE3	Compiler Construction	VO1 PS1
		Formal Language and Automata Theory	VO3 PS2