Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Automotive Software Technology

Module code	555010
Module title	Formal Specification and Verification
Responsibility	Professorship Computer Engineering
Content and qualification aims	Content: Theoretical basics of system modeling and simulation; system life cycle and system development processes; formal specification technology for embedded systems – selected technologies from the aerospace industry; formal verification of functional and non-functional characteristics of embedded systems; security aspects of embedded systems and technologies for their verification Qualification aims: ability of formal specification; knowledge about verification procedures
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Formal Specification and Verification (2 teaching hours) • Exercise: Formal Specification and Verification (2 teaching hours) Courses are supported by e-learning and can also be offered in English.
Participation requirements	Knowledge about basics in Computer Engineering and basic knowledge in Hardware/Software Co-design similar to module 555070
Applicability	Master's programs at the Faculty of Computer Science
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 90-minute written exam in Formal Specification and Verification
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Automotive Software Technology

Module code	577050
Module title	Software Engineering – advanced
Responsibility	Professorship Information Systems and Software Engineering
Content and qualification aims	Content: software inspection procedure, software production procedure, prototyping, configuration management, version management, project management, methods of effort assessment, software metrics, software quality, maintenance and software evolution, advanced concepts of programming, generic programming, templates, reflection in Java, design patterns (singleton, decorator, adaptor, factory), adaptive programming, aspect-oriented programming Qualification aims: Basic knowledge about problems that may occur during the industrial production of software
Teaching method	The teaching method is a lecture. • Lecture: Software Engineering – advanced (2 teaching hours)
Participation requirements	none
Applicability	Bachelor's program in Applied Computer Science
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 60-minute written exam in Software Engineering – advanced
Credit points and grades	3 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 90 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Automotive Software Technology

Module code	555170
Module title	Practical Training Automotive Software Engineering
Responsibility	Professorship Computer Engineering
Content and qualification aims	Content: The practical training sessions provide students with in-depth insights into the software development for controllers. They focus especially on the aspects of communication and standardization. Qualification aims: Gaining knowledge and abilities of designing and testing controller functions.
Teaching method	The teaching methods are practical training sessions. • Practical training (2 teaching hours) Courses are supported by e-learning and can also be offered in English.
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • Exam performances students can get credit for: a 20-minute presentation of the results of the practical training as well as a report (length 10-12 pages, workload 10 working hours) The exam performance can only be accredited if the grade is at least "sufficient".
Credit points and grades	2 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 60 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Automotive Software Technology

Module code	561030
Module title	Multicore Programming
Responsibility	Professorship Practical Computer Science
Content and qualification aims	Content: The lecture includes: a short overview of multicore processors, thread approaches to multicore programming, language approaches to multicore programming, library approaches to multicore programming, Java threads, new language approaches, transactional memory Qualification aims: knowledge of all concepts and recent developments in multicore programming as well as their applicability to software development for multicore architectures
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Multicore Programming (2 teaching hours) • Exercise: Multicore Programming (2 teaching hours)
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 90-minute written exam in Multicore Programming
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Embedded Systems

Module code	555110
Module title	Software Platforms for Automotive Systems
Responsibility	Professorship Computer Engineering
Content and qualification aims	Content: Controllers are highly networked embedded systems which implement numerous functions in vehicles. The number as well as the networking of control units is increasing in modern vehicles. Specific architectures, development methods and processes are applied to manage the complexity. The module offers an essential introduction to the topic of "Development of Automotive Controllers". According to the V-model, relevant processes methods and technologies are considered. Main points are: • Specification methods such as MSC • Technical structure of controllers • System architectures/communication busses such as CAN, LIN, FelxRay • Software platform – AUTOSAR • Testing and validation methods such as HIL, SIL, test automation Qualification aims: basic knowledge about development and structure of automotive controllers; specific knowledge about system architecture, bus technologies as well as designing and testing controllers
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Software Platforms for Automotive Systems (2 teaching hours) • Exercise: Software Platforms for Automotive Systems (1 teaching hour) Courses are supported by e-learning and can also be offered in English.
Participation requirements	none
Applicability	Master's programs at the Faculty of Computer Science
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 90-minute written exam in Software Platforms for Automotive Systems
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Embedded Systems

Module code	565050
Module title	Design for Software of Embedded Systems
Responsibility	Operating Systems Group
Content and qualification aims	<u>Content:</u> programming of real-time systems and controllers; basics of control systems; PEARL; Simulink; system software <u>Qualification aims:</u> Gaining the ability of programming in embedded environments, especially in the automotive field
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Design for Software of Embedded Systems (2 teaching hours) • Exercise: Design for Software of Embedded Systems (2 teaching hours)
Participation requirements	Knowledge in Operating Systems and Real-Time Systems
Applicability	Bachelor's and Master's programs at the Faculty of Computer Science
Credit point requirements	It is necessary to meet the requirements for admission to the exam and to pass it for credits to be awarded. To be eligible to sit the exam, students need to successfully complete a project (can be repeated more than once): • Software project Design for Software of Embedded Systems (to be done within 5 weeks)
Module examination	The module includes one examination: • 30-minute oral exam in Design for Software of Embedded Systems
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Embedded Systems

Module code	555070
Module title	Hardware/Software Co-design I
Responsibility	Professorship Computer Engineering
Content and qualification aims	Content: • Insight into several design methods and structuring for embedded systems • Overview and comparison of target architectures and components for hardware/software systems • Particular problems in hardware and software synthesis • Partitioning methods • Hardware/software bipartitioning Qualification aims: basic understanding of hardware/software co-design
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Hardware/Software Co-design I (2 teaching hours) • Exercise: Hardware/Software Co-design I (2 teaching hours) Courses are supported by e-learning and can also be offered in English.
Participation requirements	Knowledge about the basics in Computer Engineering
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 90-minute written exam in Hardware/Software Co-design I
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Embedded Systems

Module code	555090
Module title	Hardware/Software Co-design II
Responsibility	Professorship Computer Engineering
Content and qualification aims	Content: • Evaluation of design parameters • Rapid prototyping/emulation • Hardware/software co-simulation • Hardware/software co-specification with SystemC • Overview of hardware/software interfaces • Interface synthesis Qualification aims: in-depth understanding of hardware/software co-design
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Hardware/Software Co-design II (2 teaching hours) • Exercise: Hardware/Software Co-design II (2 teaching hours) Courses are supported by e-learning and can also be offered in English.
Participation requirements	Knowledge about the basics in Computer Engineering and basic knowledge in Hardware/Software Co-design I
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 90-minute written exam in Hardware/Software Co-design II
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Embedded Systems

Module code	420001
Module title	Automotive Sensor Systems
Responsibility	Professorship Microtechnology / Measurement and Sensor Technology
Content and qualification aims	Content: • General aspects of sensor application in vehicles • Sensors for engine management • Chassis sensors • Sensors for active and passive safety systems (ABS, ESC,…) • Driving assistance systems • Sensors for air quality control • Exhaust gas sensor • Sensors for acceleration, force, pressure, rotational speed • Self-check and self-calibration for robustness Qualification aims: overview of various principles and realization possibilities of sensors for automotive applications
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Hardware/Software Co-design II (2 teaching hours) • Exercise: Hardware/Software Co-design II (2 teaching hours) Courses of the module are taught in English.
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module examination consists of two parts: • 30-minute oral exam in Automotive Sensor Systems • Technical report (length 10 to 15 pages) Both parts have to be done in English.
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations. Exam performances: • Oral exam in Automotive Sensor Systems, weighting 1 • Technical report, weighting 1
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Embedded Systems

Module code	422002
Module title	Technologies for Micro and Nano Systems
Responsibility	Professorship Microtechnology
Content and qualification aims	Content: • Process steps for Si MEMS/NEMS (doping, layer deposition, lithography, 3D patterning, thinning, wafer bonding) • Process steps for non-Si NEMS/MEMS (layer deposition, injection molding, molding, mounting) • Si-based technologies (bulk technology, surface technology, high-aspect-ratio technology, thin-film encapsulation) • Technologies for alternative materials (LIGA, polymer-based process flows) • Packaging and 3D integration technologies • Measurement techniques for MEMS/ NEMS • Examples of Si MEMS (spectrometers, inertial sensors, RF MEMS, actuators) • Examples of non-Si MEMS (large-area arrays, fluidic systems, lab-on-a-chip) • Examples of nano components and NEMS (nano resonators, surface plasmon • resonance, sub-wavelength gratings, examples of smart systems) • Trends and roadmaps Qualification aims: Learning about technological steps and process flows of MEMS and MEMS components and systems, technologies for innovative MEMS and NEMS, technologies for system integration
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Technologies for Micro & Nano Systems (2 teaching hours) • Exercise: Technologies for Micro & Nano Systems (2 teaching hours) Courses of the module can also be offered in English.
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module examination consists of two parts: • 120-minute written exam in Automotive Sensor Systems The exam has to be done in English.
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Embedded Systems

Module code	422001
Module title	Advanced Integrated Circuit Technology
Responsibility	Professorship Microtechnology
Content and qualification aims	Content: • Requirements and trends concerning the semiconductor technology roadmap • Processes of micro and nano electronics (thin film deposition, ion implantation, advanced lithography, etching/patterning, chemical mechanical polishing, modern cleaning procedures) including new process steps • CMOS/Bipolar/BiCMOS technology • CMOS process modules for modern IC technologies (STI, gate, source/drain, interconnect modules, packaging etc.) • Specific aspects of sub-100-nm CMOS technology • New transistor and memory concepts; potential post-CMOS technologies • 3D technology for increased integration density • Numerical methods for semiconductor-process and equipment simulation • Models and programming for modern deposition techniques (Monte Carlo and molecular dynamics calculations) • Parameter optimization/applied programming in Java Qualification aims: understanding about basics and trends in modern integrated circuit technology, knowledge about process steps and modules; knowledge about physical models for semiconductor processes, methodology and tools for process and equipment simulation, programming practice
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Advanced Integrated Circuit Technology (3 teaching hours) • Exercise: Advanced Integrated Circuit Technology (1 teaching hour) Courses of the module are taught in English.
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 120-minute written exam in Advanced Integrated Circuit Technology
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Real-Time and Communication Systems

Module code	553090
Module title	Protocols of Distributed Systems
Responsibility	Professorship Distributed and Self-organizing Systems
Content and qualification aims	Content: In the last past years computer- and communication networks have developed to an efficient tool, a universal information source and a ubiquitous communication medium. We can no longer imagine everyday live without them. They are created by connecting various distributed systems, which enable information exchange among each other. Exchange and forwarding of the data is realized with the help of suitable methods and algorithms, which are called protocols. Basic approaches, concepts and principles of modern communication- and computer networks are deepened. Beyond that the technologies of internet and world wide web are focused. A further emphasis is laid on modern protocols and current developments in the area of web services and service oriented architectures (SOA). Qualification aims: basic understanding of protocol mechanisms of distributed systems in the internet and world wide web; in-depth knowledge of approaches and technologies in the field of SOA and web services
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Protocols of Distributed Systems (2 teaching hours) • Exercise: Protocols of Distributed Systems (2 teaching hours) Courses are supported by e-learning and can also be offered in English.
Participation requirements	Basic knowledge in Computer Networks similar to module 553110 Computer Networks
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 20-minute oral exam in Protocols of Distributed Systems
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Real-Time and Communication Systems

Module code	416002
Module title	Mobile Networks
Responsibility	Professorship Communication Networks
Content and qualification aims	Content: • Introduction: types of mobility, classification of wireless networks • Technical basics: mobile radio channel, transmission methods (multiple access, duplex), cellular principle • Public cellular networks (GSM, UMTS): introduction, system architecture, wireless interface, protocols, call and mobility management, security concepts, services, outlook (4G/LTE) • Wireless MANs (WiMAX): introduction, system architecture, wireless interface, protocols, mobility management, security concepts, outlook • Wireless LANs (WLAN): introduction, IEEE 802.11 standardization, system and protocol architecture, wireless interface (focus on MAC layer), methods for mobility support, security concepts, outlook • Wireless PANs (Bluetooth, ZigBee) Qualification aims: Providing students with fundamental knowledge about the functioning of wireless communication networks; learning about the most important recent mobile networks
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Mobile Networks (2 teaching hours) • Exercise: Mobile Networks (1 teaching hour) Courses can also be offered in English.
Participation requirements	Basic knowledge of communication networks is recommended.
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 120-minute written exam in Mobile Networks
Credit points and grades	3 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 90 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Real-Time and Communication Systems

Module code	416001
Module title	Self-organizing Networks
Responsibility	Professorship Communication Networks

Content and qualification aims	Content:
	• Part 1: Basics
	  ◦ Characteristics of self-organization
	  ◦ Mathematical basics (graph theory, models,…)
	• Part 2: Mobile ad hoc networks (MANETs)
	  ◦ Introduction (definition, classification, application scenarios,…)
	  ◦ Routing procedures in MANETs
	  ◦ media access control (MAC)
	  ◦ topology control and cluster formation
	  ◦ security aspects
	  ◦ analysis and performance assessment of MANETs
	  ◦ Special features of WSANs (wireless sensor and actor networks)
	  ◦ outlook
	• Part 3: Peer-to-peer (P2P) networks
	  ◦ Introduction (definition, classification, architecture options,…)
	  ◦ Unstructured P2P networks (examples: Gnutella, Kazaa…)
	  ◦ Structured P2P networks (examples: DHT, Chord, CAN, Kademlia…)
	  ◦ P2P applications and examples of implementation
	  ◦ Analysis and performance assessment of peer-to-peer networks
	  ◦ outlook
	
	Qualification aims:
	Providing students with detailed knowledge about mobile ad hoc and peer-to-peer networks

Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Self-Organizing Networks (2 teaching hours) Courses can also be offered in English.
Participation requirements	Basic knowledge of communication networks is recommended
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 120-minute written exam in Self-Organizing Networks
Credit points and grades	2 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 60 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	553130
Module title	Security of Distributed Systems
Responsibility	Professorship Distributed and Self-Organizing Systems
Content and qualification aims	Content: The focus is on the issue of security of computer networks and in the connected application systems. Attacking possibilities and weak points are highlighted and safety concepts shall be discussed. Among other things, the following topics will be covered: • Introduction to identity, dangers, risks, healing and security • Introduction to cryptography methods and approaches • Identity and access management, e.g. provisioning, policies, Single sign-on (SSO), directory services, RBAC, 802.1X • Approaches, services and tools of computer network security, e.g. IPSec, Kerberos, certificates, LDAP, RADIUS, firewalls, IDS, sniffers, scanners • Application-oriented security, e.g. for data transmission, e-mail and web applications • Management and security aspects of wireless local networks • User rights federation, e.g. shibboleth, ws federation, Liberty Alliance • Measures of systematically planning, execution and surveillance of security • Trends, e.g. self-management, self-healing Qualification aims: basic understanding of mechanisms for securing computer systems as well as identity and authorization management, proficiency in XML applications and tools, learning about systematic approaches to security of distributed systems
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Security of Distributed Systems (2 teaching hours) • Exercise: Security of Distributed Systems (2 teaching hours) Courses are supported by e-learning and can also be offered in English.
Participation requirements	Basic knowledge in Computer Networks similar to module 553110 Computer Networks
Applicability	Bachelor's program in Applied Computer Science
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 20-minute oral exam in Security of Distributed Systems
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	500310
Module title	Focal Points in Computer Science
Responsibility	Dean of Studies, Faculty of Computer Science
Content and qualification aims	Content: Computer Science is a vibrant science with new discoveries being made continuously. The module Focal Points in Computer Science includes these discoveries. Qualification aims: Introduction to recent topics; gaining knowledge about and discussing cutting-edge technologies
Teaching method	Teaching methods are a lecture and practical training sessions. • Lecture: Focal Points in Computer Science (2 teaching hours) • Practical training: Focal Points in Computer Science (2 teaching hours) Courses are supported by e-learning and can also be offered in English.
Participation requirements	Knowledge of fundamental technologies in computer science
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • Exam performances students can get credit for: a 90-minute written exam about the lecture and the practical training Focal Points in Computer Science The exam performance can only be accredited if the grade is at least "sufficient".
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	553010
Module title	Architecture of Distributed Systems
Responsibility	Professorship Distributed and Self-organizing Systems
Content and qualification aims	Content: The continuous and fast technological change is both challenge and chance. IT systems need to be adaptive and flexible as well as integrative and self-organizing to meet organizational objectives. The software architecture of those systems has to consider various aspects of distributed systems to meet the requirements and essential quality criteria. First the module introduces fundamental architecture approaches and provides students with a profound and broad knowledge about aspects, description methods, principles and technologies, all of which are necessary for planning and implementing the aforementioned IT systems. The focus is on practical examples concerning internet and world wide web- based applications and systems. Proven languages, frameworks and standards will be introduced for the modeling and design of distributed system architectures. Moreover aspects of information integration and hypermedia systems as well as recent experiences, trends and solution approaches will be discussed. Qualification aims: In-depth understanding of architecture aspects of distributed systems as well as solution approaches to design, implementation and operation; basic knowledge about frameworks, methods, models, principles and tools for supporting architecture-specific problems.
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Architecture of Distributed Systems (2 teaching hours) • Exercise: Architecture of Distributed Systems (2 teaching hours) Courses are supported by e-learning and can also be offered in English.
Participation requirements	Basic knowledge in Computer Networks similar to module 553110 Computer Networks
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 20-minute oral exam in Architecture of Distributed Systems
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Module in the field of Computer Science

Module code	571010
Module title	Computer Aided Geometric Design
Responsibility	Professorship Graphic Data Processing and Visualization
Content and qualification aims	Content: The generation of computer graphics requires geometric models of the objects that are to be visualized. The lecture discusses techniques and algorithms for the generation and manipulation of so-called free-form geometries, which are essential for the modeling of complex surfaces (e.g. car bodies, wings of a plane). • Curves and surface representation • Interpolation • Approximation • Splines • Bézier curves and surfaces • B-spline curves and surfaces Qualification aims: basic knowledge about the modeling of free-form curves and surfaces.
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Computer Aided Geometric Design (2 teaching hours) • Exercise: Computer Aided Geometric Design (2 teaching hours) Courses can also be offered in English.
Participation requirements	none
Applicability	---
Credit point requirements	It is necessary to meet the requirements for admission to the exam and to pass it for credits to be awarded. To be eligible to sit the exam, students need to successfully complete some assignments (can be repeated more than once): • Submission of 4 – 12 tasks in Computer Aided Geometric Design. Requirements for admission are met if at least half of the tasks are completed correctly.
Module examination	The module includes one examination: • 90-minute written exam in Computer Aided Geometric Design
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	573070
Module title	Neurocognition I
Responsibility	Professorship Artificial Intelligence
Content and qualification aims	Content: Neurocognition is a new branch of cognitive science, which is based on the knowledge concerning cognition gained by neuroscientific research in recent years. This knowledge modernizes the basis of cognitive sciences. The lecture illustrates how realistic neuronal models are generated and how they can be used for research on the functioning of the human brain. It will be shown how typical cognitive activities such as learning, focusing of attention, object recognition and so on can be explained as operations in neural networks. Practical tasks on a computer are required to deepen the understanding about the matter. Qualification aims: basic knowledge of neurocognition in theory and practice.
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Neurocognition I (2 teaching hours) • Exercise: Neurocognition I (2 teaching hours) Courses are supported by e-learning and can also be offered in English.
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 25-minute written exam in Neurocognition I
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	573130
Module title	Neurocognition II
Responsibility	Professorship Artificial Intelligence
Content and qualification aims	Content: Neurocognition II examines more complex models of neuropsychological processes to develop new algorithms for intelligent cognitive robots. Relevant topics are perception, memory, action control, emotions, decisions and spatial perception. Practical tasks on a computer are required to deepen the understanding about the matter. Qualification aims: Subject-specific knowledge of neurocognition in theory and practice
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Neurocognition II (2 teaching hours) • Exercise: Neurocognition II (2 teaching hours) Courses are supported by e-learning and can also be offered in English.
Participation requirements	Knowledge from Neurocognition I (module 573070)
Applicability	---
Credit point requirements	It is necessary to meet the requirement for admission to the exam and to pass it for credits to be awarded. The requirement for admission is: • Successful completion of Neurocognition I (module 573070)
Module examination	The module includes one examination: • 25-minute oral exam in Neurocognition II
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	578010
Module title	Media Applications
Responsibility	Professorship Media Informatics
Content and qualification aims	Content: Different application areas (e-learning, retrieval, IP-based streaming, interactive TV, hypermedia, mobile devices, etc.) and their respective technological bases (encoding methods, file formats) will be discussed. Qualification aims: Students know basic technologies and mechanisms of several media. They can produce and handle various media applications.
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Media Applications (2 teaching hours) • Exercise: Media Applications (2 teaching hours) Courses are supported by e-learning and can also be offered in English.
Participation requirements	none
Applicability	Bachelor's programs at the Faculty of Computer Science Master's program in Computer Science for Journalists Programs that include courses related to Computer Science
Credit point requirements	It is necessary to meet the requirements for admission to the exam and to pass it for credits to be awarded. To be eligible to sit the exam, students need to successfully complete an assignment (can be repeated more than once): • 20-minute presentation in Media Applications
Module examination	The module includes one examination: • 60-minute written exam in Media Applications
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available once per academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	578050
Module title	Media Encoding
Responsibility	Professorship Media Informatics
Content and qualification aims	Content: Central aspects of encoding media data. The focus is on compression techniques, data formats, streaming methods. Qualification aims: Students gain an in-depth knowledge of theories, concepts, methods, techniques and mechanisms of media.
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Media Encoding (2 teaching hours) • Exercise: Media Encoding (2 teaching hours) Courses are supported by e-learning and can also be offered in English.
Participation requirements	Basic technical knowledge of media
Applicability	Bachelor's programs at the Faculty of Computer Science Master's program in Computer Science for Journalists Programs that include courses related to Computer Science
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 60-minute written exam in Media Encoding
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available in every other academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	578070
Module title	Media Ergonomics
Responsibility	Professorship Media Informatics
Content and qualification aims	Content: Media Ergonomics discusses possibilities of human-computer interaction, especially concerning multimedia contents. Qualification aims: Students g ain an in-depth knowledge of theories, concepts, methods, techniques and mechanisms of media.
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Media Ergonomics (2 teaching hours) • Exercise: Media Ergonomics (2 teaching hours) Courses are supported by e-learning and can also be offered in English.
Participation requirements	Basic technical knowledge of media
Applicability	Bachelor's programs at the Faculty of Computer Science Master's program in Computer Science for Journalists Programs that include courses related to Computer Science
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 60-minute written exam in Media Ergonomics
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available in every other academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	578150
Module title	Media Programming
Responsibility	Professorship Media Informatics
Content and qualification aims	Content: Based on the programming language Java, various aspects of multimedia programming such as graphics programming, image modification, audio/video streaming, telephony, etc. will be discussed. Qualification aims: Students gain in-depth knowledge of theories, concepts, methods, techniques and mechanisms of media.
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Media Programming (2 teaching hours) • Exercise: Media Programming (2 teaching hours) Courses are supported by e-learning and can also be offered in English.
Participation requirements	Basic technical knowledge of media, basic knowledge of programming
Applicability	Bachelor's programs at the Faculty of Computer Science Master's program in Computer Science for Journalists Programs that include courses related to Computer Science
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 60-minute written exam in Media Programming
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available in every other academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	561010
Module title	Compiler Construction
Responsibility	Professorship Practical Computer Science
Content and qualification aims	Content: The lecture introduces concepts and techniques of compiler construction that are required for the development of a compiler. All conceptual phases of a compiler from lexical analysis to code generation will be discussed. Moreover, students shall learn about techniques for an efficient automated analysis and processing of hierarchically structured documents. The knowledge gained in the lecture will be applied in accompanying exercises. Qualification aims: Knowledge of concepts and phases in compiler construction as well as the ability to apply basic techniques of compiler construction in practice and in other fields.
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Compiler Construction (2 teaching hours) • Exercise: Compiler Construction (2 teaching hours)
Participation requirements	none
Applicability	Bachelor's programs at the Faculty of Computer Science
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 90-minute written exam in Compiler Construction
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available in every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: **Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree**

Module in the field of Computer Science

Module code	561070
Module title	Parallel Programming
Responsibility	Professorship Practical Computer Science
Content and qualification aims	Content: The lecture includes: architecture and interconnection networks of parallel systems; performance, run-time analysis and scalability of parallel programs; message-passing programming and implementation of typical communication patterns; programming and synchronization techniques for shared address space via multi-threading; co-ordination of parallel programs. Programming models and techniques are applied to various applications in the accompanying exercises. Qualification aims: Knowledge about the architecture and network structures of parallel platforms; knowledge of basic programming techniques for shared and distributed address spaces and how they are applied to various applications.
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Parallel Programming (2 teaching hours) • Exercise: Parallel Programming (2 teaching hours)
Participation requirements	none
Applicability	Bachelor's programs at the Faculty of Computer Science
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 90-minute written exam in Parallel Programming
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available in every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Automotive Software Technology

Module code	561050
Module title	Optimizations in Compiler Construction
Responsibility	Professorship Practical Computer Science
Content and qualification aims	Content: The lecture discusses classic optimization methods in compiler construction and optimization methods for memory hierarchies or parallel computers. The following topics will be covered: • Data flow analysis and optimizing transformations for improving the program behavior; • Data dependency analysis for exploiting multiple functional units of modern microprocessors; • Locality and parallelism analysis of programs; • Program transformations to optimize programs for computers with memory hierarchies Qualification aims: Knowledge of optimizations in compiler construction
Teaching method	Teaching methods are a lecture and an exercise. • Lecture: Optimizations in Compiler Construction (2 teaching hours) • Exercise: Optimizations in Compiler Construction (2 teaching hours)
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • 90-minute written exam in Optimizations in Compiler Construction
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available in every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Key Competences

Module code	500410
Module title	German as Foreign Language
Responsibility	Dean of Studies, Faculty of Computer Science
Content and qualification aims	Content: • Improvement and consolidation of the lexis i.a. on the topics education, activities, hobbies, spare time and profession • Discovery and exercise of new grammatical structures e.g. separable and non-separable verbs, reflexive verbs, stabilization of tenses, exercises on word order in different sentence constructions. • Exercises on German phonetic The education is geared to the language proficiency level A2 of the Common European Framework of Reference for Languages (CEFR) Qualification aims: • Understanding of often used terms, concerning areas of direct relevance • Communication about familiar and prevalent topics by simple, direct information exchange Passing the exam corresponds to the language proficiency level A2 of the Common European Framework of Reference for Languages (CEFR)
Teaching method	Teaching method is the exercise. • Exercise: German as foreign language (Course 2) (4 teaching hours)
Participation requirements	• Passed preceding course 1 or placement test (Qualification recommendation) • The students mother tongue must not be German
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes two examination performances: • 90-minute written exam German as foreign language (course 2) • Translation of a subject-specific text between 2 and 6 pages The exam performance is accredited if the grade is at least "sufficient".
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations. Examination performances: • Written exam German as foreign language (course 2), weighting 1 • Translation of a subject-specific text, weighting 0
Availability	The module is available once per semester.
Workload	The total workload for this module is 150 working hours (60 hours presence and 90 hours self study).
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	500330
Module title	Focal Points in Computer Science II
Responsibility	Dean of Studies, Faculty of Computer Science
Content and qualification aims	Content: Computer Science is a vibrant science with new discoveries being made continuously. Within the module Focal Points in Computer Science II special topics are deepened. Qualification aims: Deeper knowledge of current research topics on the computer science
Teaching method	Teaching methods are a lecture and practical training sessions. • Lecture: Focal Points in Computer Science II (2 teaching hours) • Practical training: Focal Points in Computer Science II (2 teaching hours) Courses are supported by e-learning and offered in English language.
Participation requirements	Knowledge of fundamental technologies in computer science
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • Exam performances students can get credit for: a 90-minute written exam about Focal Points in Computer Science II The exam performance can only be accredited if the grade is at least "sufficient". The exam can be performed in German or English language
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available every second academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	500090
Module title	Research Seminar Computer Science
Responsibility	Dean of Studies, Faculty of Computer Science
Content and qualification aims	Content: To a given problem single aspects are determined and worked independently. The seminar topic relates to the pillars of the study course. The students work on the topic on their own, present it for discussion and write a paper, which meets the requirements of a scientific thesis. Qualification aims: The students are introduced to independent work on research-relevant problems
Teaching method	Teaching method is the seminar. • Seminar: Graduate seminar computer science (2 teaching hours)
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • Exam performances students can get credit for: a 45-minute presentation in the graduate seminar and a research paper (amount 8-15 pages, editing time 8 weeks) The exam performance can only be accredited if the grade is at least "sufficient".
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered each semester.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module Research Internship

Module code	500170
Module title	Research Internship
Responsibility	Dean of Studies, Faculty of Computer Science
Content and qualification aims	Content: The internship can be made at a professorship or in a company. While the research seminar provides an overview over scientific way of working, beginning with the selection of the topic and literature research to the scientific work, the research internship focuses on research work. Both components together are the basis for a successful master-thesis in the final semester. Qualification aims: The students learn to independently work for a longer period of time on research-relevant problem.
Teaching method	Teaching method is the internship. • Internship (12 weeks) The course can also be provided in English language
Participation requirements	Knowledge in the fields of Hardware/Software-Codesign, C-programming, Automotive Software Engineering
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed. The requirement for admission is: • 30 credit points
Module examination	The module includes one examination: • reflective report (amount 20 pages, editing time 6 weeks) The exam can be performed in German or English language
Credit points and grades	15 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered each semester.
Workload	The total workload for this module is 450 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	500190
Module title	Efficient Algorithms
Responsibility	Professorship Theoretical Computer Science (-and Information Security) / Professorship Theoretical Computer Science
Content and qualification aims	Content: • Introduction into random algorithms • Analysis of average run-time of algorithms • Complex data-structures and their analysis • Combinatorial search problems Qualification aims: Methodologies of efficient algorithmitization
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Efficient Algorithms (3 teaching hours) • Exercise: Efficient Algorithms (1 teaching hours)
Participation requirements	Basic knowledge in theoretical computer science (module 500210)
Applicability	Study courses in the computer science and mathematical domain
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • a 20-minute oral exam on Efficient Algorithms
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is available every second academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	541030
Module title	Parallel Algorithms
Responsibility	Professorship Theoretical Computer Science
Content and qualification aims	Content: The classical discrete algorithms are transferred on parallel computers. Parallel complexity-classes, questions of processor-communication. Qualification aims: Recognition and understanding of the question which problems can easily parallelized. Understanding of questions concerning communication and their importance for parallel computing.
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Efficient Algorithms (3 teaching hours) • Exercise: Efficient Algorithms (1 teaching hours)
Participation requirements	Basic knowledge in theoretical computer science (module 500210)
Applicability	Study courses in the computer science and mathematics with informatics
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • a 20-minute oral exam on Parallel Algorithms
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every second academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	541090
Module title	Probability Calculation and Algorithms
Responsibility	Professorship Theoretical Computer Science
Content and qualification aims	Content: • It is shown, how the concepts of the probability calculation appear in discrete algorithms. • Additionally: randomized algorithms and input Qualification aims: Recognition, understanding and application of random phenomena.
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Efficient Algorithms (2 teaching hours) • Exercise: Efficient Algorithms (1 teaching hours)
Participation requirements	Basic knowledge in theoretical computer science, especially in algorithms
Applicability	Study courses in the computer science and mathematics with informatics
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • a 20-minute oral exam on Probability Calculation and Algorithms
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every second academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	543030
Module title	Approximation Algorithms
Responsibility	Professorship Theoretical Computer Science (-and Information Security)
Content and qualification aims	Content: • Run-times and qualities of algorithms. • Online and offline situations and geometric approximation • simple approximation-strategies as greedy-approaches and their analysis for specific problems as Maximum Independent Set, MAXCUT • randomized operations, rounding techniques and linear programming • conversion of randomized operations into deterministic operations, linear and quadratic optimization-problems and sampling Qualification aims: Aim of the module is to learn techniques of algorithmic approximation to the optimal solution of problems in polynomial time, where the exact solution can only be determined with a high computation effort. Furthermore techniques to estimate the quality of the received results are acquired. With the help of the acquired contents the student gets the competence to apply appropriate approximations on specific applications and to estimate their quality.
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Efficient Algorithms (2 teaching hours) • Exercise: Efficient Algorithms (1 teaching hours)
Participation requirements	Basic knowledge in theoretical computer science, especially in algorithms
Applicability	Study courses in the computer science and mathematics with informatics
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • a 20-minute oral exam on Approximation Algorithms
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every second academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	543070
Module title	Data Security and Cryptography
Responsibility	Professorship Theoretical Computer Science (-and Information Security)
Content and qualification aims	Content: Turing machine, computability, NP-completeness, classic and modern cryptographic methods, digital signatures, hashes Qualification aims: Understanding of aspects of the problem of complexity of algorithms and their relevance to data security
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Efficient Algorithms (2 teaching hours) • Exercise: Efficient Algorithms (2 teaching hours)
Participation requirements	none
Applicability	Bachelor Applied Informatics
Credit point requirements	Credits are awarded after fulfilling the prerequisites to take part in the examination and after the examination is successfully completed. Examination prerequisite is the following preparatory assessment: • Proof of 4 to 14 exercises to Data Security and Cryptography. The proof is accepted if at least 40% of the tasks are solved.
Module examination	The module includes one examination: • a 90-minute written exam on Data Security and Cryptography
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every second academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	555190
Module title	Hardware Development with VHDL
Responsibility	Professorship Computer Engineering
Content and qualification aims	Content: The paradigms and concepts for implementing functionality as a combinatorial or sequential digital system differ clearly from the established techniques using imperative programming languages. This course deals with the paradigms of hardware development and relates them to imperative approaches. As the description language for sequential systems VHDL is used. • VHDL basics (concepts, syntax, semantics) • comparison to imperative programming languages • combinatorial systems and their modeling • sequential systems and their modeling • modeling and realization of complex systems • practical experiences in VDHL-descriptions The practical handling of development-tools for simulation and synthesis of the VHDL-descriptions will be taught as well Qualification aims: Understanding of the hardware-development and VHDL paradigms. Practical skills to describe, simulate and synthesize combinatorial and sequential systems
Teaching method	Teaching method is the internship. • Lecture: Hardware Development with VHDL (1 teaching hours) • Internship: Hardware Development with VHDL (3 teaching hours) The course is in English language, but can also be provided in German language
Participation requirements	• Basic knowledge about digital systems (Boolean algebra, state machines, elements of the register transfer layer) • Basic knowledge in Hardware/Software Codesign
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • assignment paper (amount 5 ca. Pages) about the practical realization of a task to Hardware Development with VHDL The exam can be performed in German or English language
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered each winter semester.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Real-Time and Communication Systems

Module code	556010
Module title	Timing Aware Programming for Embedded Systems
Responsibility	Junior Professorship Software Technology for Embedded Systems
Content and qualification aims	Content: Embedded Systems normally have to react on changes in the embedded surrounding; therefor it is necessary to guarantee a correct response time. An electronic stabilization program (ESP) of a vehicle surveils the velocity, the grip and the slip of the tires and reacts if necessary to avoid sliding and slipping. To achieve this it is necessary, that the ESP reacts within deadlines. Normally programming languages as C / C++ or Java are used for the development of embedded systems, even though they are not designed for this. Specifying time-characteristics of the program is not supported which makes the test- and verification process difficult. This module introduces programming languages which are designed especially for the development of embedded software. Such programming languages enable to define the runtime performance of the program during the development. This makes it easier to guarantee the correct time behavior. Especially the so called synchronous languages Esterel and Lustre are topic in this module. The differences between synchronous and conventional programming languages are explained, as well as the pros and cons of the different programming-paradigms. Furthermore the module is accompanied by a practical exercise, which provides the possibility to gather programming experience and to get in contact with commercial tools. Qualification aims: Understanding of the difficulties during the development of real-time- and embedded systems; deep understanding of synchronous programming languages incl. their advantages and disadvantages; basic experiences with real-time-programming languages for the development of embedded systems.
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Timing Aware Programming for Embedded Systems (2 teaching hours) • Exercise: Timing Aware Programming for Embedded Systems (2 teaching hours)
Participation requirements	• Programming skills in C • basic understanding of real-time- and embedded systems
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • a 90-minute written exam on Timing Aware Programming for Embedded Systems
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	563050
Module title	Databases and Web-techniques
Responsibility	Professorship Data Management Systems
Content and qualification aims	Content: Basic techniques of web-programming to access databases, ODBC, JDBC, DCE, CORBA, COM/DCOM, portal-techniques, XML, web-services Qualification aims: The student shall learn how data, stored in databases, can be accessed through the internet. Aim is i.a. to understand web-services and to be able to apply them
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Databases and Web-techniques (2 teaching hours) • Exercise: Databases and Web-techniques (2 teaching hours)
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after fulfilling the prerequisites to take part in the examination and after the examination is successfully completed. Examination prerequisite is the following preparatory assessment: • Proof of 4 to 14 exercises to Data Security and Cryptography. The proof is accepted if at least 40% of the tasks are solved.
Module examination	The module includes one examination: • a 90-minute written exam on Databases and Web-techniques
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	563090
Module title	Databases and Object Orientation
Responsibility	Professorship Data Management Systems
Content and qualification aims	<u>Content:</u> Enhancements of the relational data-model leading to the object-oriented data-model in databases; finally with the object-relational approach to modern database-systems <u>Qualification aims:</u> The student shall theoretically and practically learn how the relational modeling approach, via semantic data-modeling and object-oriented database-models has lead to the modern object-relational systems.
Teaching method	Teaching method is the internship. • Lecture: Databases and Object Orientation (2 teaching hours) • Internship: Databases and Object Orientation (2 teaching hours)
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes two examination performances: • Homework on Databases and Object Orientation (programming task) (editing time 6 weeks) • a 15-minute presentation of the solution The exam performance is accredited if the grade is at least "sufficient".
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations. Examination performances: • Homework on Databases and Object Orientation (programming task), weighting 1 • Presentation of the solution, weighting 1
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Embedded Systems

Module code	565010
Module title	Operating Systems for Distributed Systems
Responsibility	Professorship Operating Systems
Content and qualification aims	Content: Special problems of operating systems in distributed systems; algorithms for basic-problems (mutex, termination, selection, etc); clocks in distributed systems, group communication; mapping and load-balancing; names; distributed operating systems; distributed transactions; examples (e.g. Mach, Plan9/Inferno, Amoeba) Qualification aims: Acquisition of understanding of problems concerning operating systems in distributed systems; knowledge in distributed algorithms; knowledge in functionality and design of operating systems for distributed systems
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Operating Systems for Distributed Systems (2 teaching hours) • Exercise: Operating Systems for Distributed Systems (2 teaching hours)
Participation requirements	Basic knowledge in operating systems
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • a 30-minute oral exam on Operating Systems for Distributed Systems
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Real-Time and Communication Systems

Module code	565030
Module title	Real-time Systems
Responsibility	Professorship Operating Systems
Content and qualification aims	<u>Content:</u> Theory and practice of computing systems, which can be used for the solution of time critical tasks. The following topics are covered: time-management and -standards; clocks, scheduling algorithms (priority inversion, ~ inheritance, ~ ceiling); mass-storage management; caching and ram-management, error tolerance in real-time systems; real-time suitable communication mechanisms and -protocols; processor architectures for real-time systems; real-time operating systems <u>Qualification aims:</u> Knowledge in the general basics of real-time systems
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Real-time Systems (2 teaching hours) • Exercise: Real-time Systems (2 teaching hours)
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • a 90-minute written exam on Real-time Systems
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	565110
Module title	Analysis and Modeling of Operating System Aspects
Responsibility	Professorship Operating Systems
Content and qualification aims	Content: Quantitative and qualitative modeling and analysis of operating system phenomena Qualification aims: Acquisition of the skills to evaluate and to model an operating system
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Analysis and Modeling of Operating System Aspects (2 teaching hours) • Exercise: Analysis and Modeling of Operating System Aspects (2 teaching hours) The course can also be provided in English language
Participation requirements	Basic knowledge in operating systems and in probability calculation/ stochastic theory
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • a 30-minute oral exam on Analysis and Modeling of Operating System Aspects The exam can be performed in German or English language
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Real-Time and Communication Systems

Module code	565130
Module title	Dependable Systems
Responsibility	Professorship Operating Systems
Content and qualification aims	Content: Basic approaches and measures for error margins; error-models; techniques of fault diagnostics; error margin on system layer; errors in software; modeling Qualification aims: Acquisition of the skills to analyze the system dependability and basic understanding of problems concerning the development of dependable systems
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Dependable Systems (2 teaching hours) • Exercise: Dependable Systems (2 teaching hours) The course can also be provided in English language
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • a 90-minute written exam on Dependable Systems The exam can be performed in German or English language
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	573090
Module title	Robotics
Responsibility	Professorship Artificial Intelligence
Content and qualification aims	Content: The lecture provides an introduction into robotics, where especially means and methods of the artificial intelligence are focused. Focal point is the consideration of autonomous mobile robots. Also hints for building his own little mobile robot are provided. The students have the possibility to apply their acquired knowledge in an internship. • Introduction • Build up of a partial system of a robot • Examples of autonomous mobile robots • Hints for building his own robot • Programming robots • Robot kinematics • Robotics and planing • Navigation of mobile robots Qualification aims: Basic practical knowledge of autonomous mobile robots (programming, sensors, robot-specific problems). Getting to know current techniques to navigate a mobile robot
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Robotics (2 teaching hours) • Internship: Robotics (4 teaching hours)
Participation requirements	Knowledge in Neurocognition I (module 573070)
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • a 25-minute oral exam on Robotics
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within two semesters.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module Master Thesis

Module code	9100_M
Module title	Master Thesis
Responsibility	Dean of Studies, Faculty of Computer Science
Content and qualification aims	Content: In this module a master thesis is written and publicly defended. The topic correlates to one of the specialization areas. In the master thesis and the final defense, the students proof to be able to scientific work on a limited, but challenging topic within a certain time limit. Qualification aims: The students are able to scientific work on a limited topic within a certain time limit.
Teaching method	---
Participation requirements	The master thesis can be performed at any professorship of the computer science faculty. The topic of the thesis should come to an agreement with the responsible professorship of the specialization area.
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes two examinations: • Master Thesis (amount ca. 80 pages, editing time 23 weeks) • ca. 45-minute oral exam (colloquium) (ca. 30 min. presentation and ca. 15 min. discussion) The exam can be performed in German or English language
Credit points and grades	30 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations. Exam performances: • Master thesis, weighting 2 • Oral exam, weighting 1
Availability	The module is offered each semester.
Workload	The total workload for this module is 900 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Key Competences

Module code	613002
Module title	Entrepreneurship
Responsibility	Professorship Marketing
Content and qualification aims	Content: The students have critical look on all aspects of professional self-employment and the foundation of a business company. This includes ideation and rating the ideas, creation of a business plan, founding and management of start-ups and small and medium sized companies. Qualification aims: The students shall, by teaching basic knowledge in entrepreneurship, acquire the skill to individually have a critical look on entrepreneurial thinking and acting. Furthermore, by providing a look into the work and the way of living of young entrepreneurs, they shall be sensitized for the perspective entrepreneurship and prepared to create an own business plan for a business idea.
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Entrepreneurship (2 teaching hours) • Exercise: Entrepreneurship (2 teaching hours)
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after fulfilling the prerequisites to take part in the examination and after the examination is successfully completed. Examination prerequisite is the following preparatory assessment (several times repeatable): • Creation of a business plan (amount ca. 40 pages) in small groups (2-4 students)
Module examination	The module includes one examination: • a 60-minute written exam on Entrepreneurship
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Key Competences

Module code	613004
Module title	Technical Sales and Distribution
Responsibility	Professorship Marketing
Content and qualification aims	Content: Especially for technically oriented companies and SMEs the technical sales to corporate customers has a key-function. The lecture provides extensive knowledge in the course of business-to-business transactions. Besides the profound theoretical basics also a one-day-workshop is mandatory part of the lecture. In this workshop the participants train to apply their acquired knowledge on personal selling in realistic role-playings. The usage of video-equipment and structured feedback enables the student a realistic reflection of the own skills. Qualification aims: By this lecture the students shall learn, basic knowledge in organization and the course of selling-processes in the industrial area. With the emphasis on direct and personal selling they shall educe sound capabilities in these areas. Integrating practical exercises on different selling situations shall significantly increase the abilities to present and to structure, as well as the ambiguity tolerance of the participants.
Teaching method	Teaching method is the lecture. • Lecture: Technical Sales and Distribution (2 teaching hours) • In addition it is mandatory to take part in a one-day-workshop
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • a 90-minute written exam on Technical Sales and Distribution
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within one semester.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	571050
Module title	Computer Graphics I
Responsibility	Professorship Computer Graphics and Visualization
Content and qualification aims	Content: Introduction into the area of computer graphics, considering the following topics. • Structure of graphical systems • Color models • Windowing and clipping • Raster algorithms • Transformations of the view • Hidden surface algorithms • Lighting models • Shading The graphics standard OpenGL is used. Qualification aims: Basic knowledge in the area of visualization of graphical models, knowledge in programming OpenGL
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Computer Graphics I (2 teaching hours) • Exercise: Computer Graphics I (2 teaching hours)
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after fulfilling the prerequisites to take part in the examination and after the examination is successfully completed. Examination prerequisite is the following preparatory assessment: • Proof of 4 to 12 exercises to Computer Graphics I. The proof is accepted if at least 50% of the tasks are correctly solved.
Module examination	The module includes one examination: • a 90-minute written exam on Computer Graphics I and a 30-minute presentation of a OpenGL-programming project
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within two semesters.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	571110
Module title	Computer Graphics II
Responsibility	Professorship Computer Graphics and Visualization
Content and qualification aims	<u>Content:</u> Continuation of the introduction to computer graphics. Working on the topics: textures, shadowing, realt-time rendering, volume visualization, global lighting methods, special modeling techniques <u>Qualification aims:</u> Deep knowledge in the area of visualization of graphical models, deep knowledge in programming OpenGL
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Computer Graphics II (2 teaching hours) • Exercise: Computer Graphics II (2 teaching hours)
Participation requirements	Basic knowledge in Computer Graphics according to module 571050 Computer Graphics I
Applicability	---
Credit point requirements	Credits are awarded after fulfilling the prerequisites to take part in the examination and after the examination is successfully completed. Examination prerequisite is the following preparatory assessment: • Proof of 4 to 12 exercises to Computer Graphics II. The proof is accepted if at least 50% of the tasks are correctly solved.
Module examination	The module includes one examination: • a 90-minute written exam on Computer Graphics II
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within two semesters.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	571150
Module title	Basics of Computer Geometry
Responsibility	Professorship Computer Graphics and Visualization
Content and qualification aims	Content: This module provides geometric basic knowledge, which is relevant for the understanding of the computer graphics methods and algorithms. Topics: • Affine spaces • Intersection problems • Polygons • Triangulation • Convex hull • Neighborhood problems • Parametrized curves Qualification aims: Basic mathematical and algorithmic knowledge to handle elementary geometric tasks using a computer
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Basics of Computer Geometry (2 teaching hours) • Exercise: Basics of Computer Geometry (2 teaching hours)
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after fulfilling the prerequisites to take part in the examination and after the examination is successfully completed. Examination prerequisite is the following preparatory assessment: • Proof of 4 to 12 exercises to Basics of Computer Geometry. The proof is accepted if at least 50% of the tasks are correctly solved.
Module examination	The module includes one examination: • a 90-minute written exam on Basics of Computer Geometry
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within two semesters.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	571210
Module title	Solid Modeling
Responsibility	Professorship Computer Graphics and Visualization
Content and qualification aims	Content: Modern CAD-systems use a volume based modeling-approach, which is called "solid modeling". In contrast to the surface oriented approach, recording the complete 3d-geometry of an object enables to perform a consistency checks of the model. In the lecture the basics of body-modeling and the most important modeling approaches CSG, B-rep and Cell-dividing are dealt with. Qualification aims: Basic knowledge in modeling volumetric objects
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Solid Modeling (2 teaching hours) • Exercise: Solid Modeling (2 teaching hours)
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after fulfilling the prerequisites to take part in the examination and after the examination is successfully completed. Examination prerequisite is the following preparatory assessment: • Proof of 4 to 12 exercises to Solid Modeling. The proof is accepted if at least 50% of the tasks are correctly solved.
Module examination	The module includes one examination: • a 90-minute written exam on Solid Modeling
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within two semesters.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	571250
Module title	Virtual Reality
Responsibility	Professorship Computer Graphics and Visualization
Content and qualification aims	Content: An introduction into the VR-technics with a presentation of central applications. After showing the VR-specific viewing- and interaction devices and their active principles, the VR-typic interaction techniques are discussed, which are used to navigate through VR-worlds, to interact with VR-objects or for cooperative working in virtual surroundings. A further emphasis is laid on aspects of modeling virtual worlds, their components, structure and interfaces before the general principle of operation and system structure of typical VR-systems and the application of special VR-basic software for system development is considered. Qualification aims: Basic knowledge in the area of virtual reality.
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Virtual Reality (2 teaching hours) • Exercise: Virtual Reality (2 teaching hours)
Participation requirements	none
Applicability	---
Credit point requirements	Credits are awarded after fulfilling the prerequisites to take part in the examination and after the examination is successfully completed. Examination prerequisite is the following preparatory assessment: • Proof of 4 to 12 exercises to Virtual Reality. The proof is accepted if at least 50% of the tasks are correctly solved.
Module examination	The module includes one examination: • a 90-minute written exam on Virtual Reality
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within two semesters.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Automotive Software Technology

Module code	573010
Module title	Image Understanding
Responsibility	Professorship Artificial Intelligence
Content and qualification aims	Content: The module provides an introduction to image understanding, especially focusing means and methods of the artificial intelligence. The emphasis is on understanding of images. Topics: • Overview over image understanding • Basics of digital image processing • Image pre-processing • Image segmentation • Characteristics of objects • Object recognition • 3D image interpretation • Motion analysis – optical flow Qualification aims: Knowledge in elementary operations of image processing, methods of object recognition and solid image interpretation.
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Image Understanding (2 teaching hours) • Exercise: Image Understanding (2 teaching hours)
Participation requirements	Basic knowledge mathematics
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • a 25-minute oral exam on Image Understanding
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within two semesters.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	573030
Module title	Introduction to Artificial Intelligence
Responsibility	Professorship Artificial Intelligence
Content and qualification aims	Content: Introduction to the area of artificial intelligence, regarding the following topics: • Intelligent agents • Problem formulation and problem types • Solving problems by seeking • Solving Problems by optimization • First-level logic, Inferences and planning • Probability methods • Neural networks • Information theory • Learning of decision trees Qualification aims: The student gets an insight into the area of artificial intelligence.
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Introduction to Artificial Intelligence (2 teaching hours) • Exercise: Introduction to Artificial Intelligence (2 teaching hours)
Participation requirements	Basic knowledge mathematics
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • a 90-minute written exam on Introduction to Artificial Intelligence
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within two semesters.

Appendix 2: Module description for the consecutive program in Automotive Software Engineering leading to a Master of Science degree

Module in the field of Computer Science

Module code	573050
Module title	Machine Learning
Responsibility	Professorship Artificial Intelligence
Content and qualification aims	Content: This module presents a part of the artificial intelligence (AI). Probabilities of transferring the learning aptitude to computers is discussed. Focused topics are: • Introduction, classification, historical overview • Learning of examples • Unsupervised learning methods • Neural networks • Reinforcement Learning Qualification aims: Knowledge and methods of machine learning
Teaching method	Teaching methods are a lecture and exercise. • Lecture: Machine Learning (2 teaching hours) • Exercise: Machine Learning (2 teaching hours)
Participation requirements	• Basic knowledge mathematics • Introduction to Artificial Intelligence (module 573030)
Applicability	---
Credit point requirements	Credits are awarded after the examination is successfully completed.
Module examination	The module includes one examination: • a 25-minute oral exam on Machine Learning
Credit points and grades	5 credit points can be awarded for the module. The evaluation of examination performances and the grading procedures are regulated in §10 of the examination regulations.
Availability	The module is offered every academic year.
Workload	The total workload for this module is 150 working hours.
Duration	The module can be completed within two semesters.