Technische Universität Dresden

Faculty of Computer Science

The present English version of the study regulations is a non-official version. It has no legal binding effect. Only the German version is legally binding.

Study regulations for the consecutive Master programme
Distributed Systems Engineering

as per (date after being signed by the rector)

Pursuant to § 36 of the Law governing the freedom of Universities in the Free State of Saxony (Sächsisches Hochschulfreiheitsgesetz - SächsHSFG) in the version of 15th January 2013 (SächsGVBl. pg. 3), the Technische Universität Dresden enacts the following Study Regulations as a statute.

Summary of contents

§ 1
Area of applicability

These Study Regulations define the objectives, the contents, the structure and the scheduling of studies within the consecutive Master programme *Distributed Systems Engineering* at the Technische Universität Dresden on the basis of the law governing the freedom of universities in the Free State of Saxony (Sächsisches Hochschulfreiheitsgesetz) and of the examination regulations.

§ 2
Aims of the programme

(1) Graduates of the Master programme *Distributed Systems Engineering* are trained to analyse problems in the field of distributed systems and, on the basis of this analysis, to develop efficient solutions. On the one hand, they acquire a sound basic knowledge of the various technical subjects included in the programme and, on the other, they benefit from the application-oriented structure of the programme and are able to apply this knowledge in practical situations. They acquire the skills necessary to design, develop and operate distributed systems and they understand different middleware architectures and their possible applications. They are familiar with mobile communication and are able to analyse distributed systems in terms of their reliability, safety and potential weaknesses.

(2) On the basis of their broad technical knowledge and their familiarity with the distributed systems international research communities, which they acquire in the modules with an international orientation, graduates are equipped to solve complex and varied tasks in the development and operation of distributed computer systems after an adequate settling-in period in industrial practice.

§ 3
Admission requirements

(1) The prerequisites for admission to the master programme Distributed Systems Engineering are regulated in the entry selection process regulations (Eignungsfeststellungsordnung) of the programme.

(2) The Admissions Committee responsible for this programme shall decide on the submission of the prerequisites specified in section (1).

(3) The students shall matriculate at the Technische Universität Dresden according to the relevant applicable conditions.

§ 4
Beginning and duration of studies

(1) Students can commence studies in the winter semester.

(2) The standard study period is four semesters and, in addition to course attendance, includes self-study and the Master examination.

§ 5
Types of teaching and learning

(1) The academic material is organised in a modular structure. The academic contents are communicated, consolidated and deepened in the individual modules by means of lectures, seminars, discussion sections, laboratory classes as well as by self-study.

(2) Lectures introduce the subject and contents of the subsidiary areas of the individual technical topics on a conceptional level.

(3) Discussion sections serve the acquisition of the necessary methodological and technical knowledge. The contents are then applied in typical subsidiary areas. They also offer the students the opportunity to discuss their solutions to set tasks in working groups and under direction.

(4) Seminars are designed to enable students to inform themselves about a selected task field on the basis of technical literature or other sources under direction, to present and justify their findings, and to discuss them in a group setting and/or to present them in writing.

(5) Laboratory classes form an integral component of the programme, serving both the practical application and deepening of the academic material learned as well as the acquisition of practical skills when working with hardware and software.

(6) Self-study provides the students with the opportunity to independently acquire both basic and advanced technical knowledge with the aid of various media (literature, eLearning etc.), either alone or in small groups.

§ 6
Structure and organisation of the programme

(1) The programme has a modular structure. The courses are held over four semesters. During the fourth semester, students work on their Master thesis and its defence.

(2) The programme is divided into one part that is compulsory for all students (mandatory modules with 42 credits) and an eligible part (elective modules with at least 48 credit points). The elective modules enable students to tailor their studies to their own individual needs and interests.

(3) Details concerning the contents and qualification aims, the types of teaching and learning employed, prerequisites, usability, frequency, the amount of work involved and the duration of the various modules can be found in the module descriptions (Appendix 1).

(4) The attached curriculum plan (Appendix 2) contains details of the ordered distribution of the modules across the semesters, (which, if adhered to, will ensure that the programme is completed within the standard study period), the nature and extent of the courses available, as well as the amount and submission dates of the required academic achievements and assessments.

(5) Classes are held in English.

(6) If the number of participants in an elective module is limited by the number of available places, students are selected in the order in which they registered. The faculty will inform students in good time and via the usual channels about the form and deadline for registration

as well as the number of places available.

(7) The available elective modules and the curriculum plan can be modified by the Faculty Council on the suggestion of the Academic Committee. The faculty will inform students via the usual channels at the beginning of the semester about the range of elective modules. The modified curriculum plan applies to those students to whom it was communicated by the faculty via the usual channels at the beginning of the semester. Upon request, the Examination Committee can review exceptions to sentence 3.

§ 7
Course contents

(1) The major focus of the Master programme *Distributed Systems Engineering* is on research.

(2) The mandatory modules comprise topics such as:
- fundamentals of the design, development and operation of distributed systems
- middleware architectures and platforms for the design of distributed applications and information systems
- design of distributed and safe systems from the point of view of reliability and data security
- basic methods, constructional elements and notations for the systematic development of large software systems using design patterns and frameworks

(3) The available elective modules comprise modules dealing with data security, networks and computer networks, distributed operating systems, simulation and component-based software development, Internet-based systems, software fault tolerance, real-time systems, microkernel-based systems, application development for mobile environments, principles of reliable systems and logic.

§ 8
Credit points

(1) ECTS credits document the average student workload and assess individual progress. One credit is equivalent to a workload of 30 hours. As a rule, students can earn 60 credit points per academic year, i.e., 30 credits per semester. A total of 120 credits can be earned on the basis of lectures and other courses (the nature and extent of which are described in the module descriptions), academic achievements and assessments, on self-study as well as on the basis of the Master thesis and its defence.

(2) In principle, credit points for modules can be earned only if students have passed the module exam. In this regard, § 27 of the examination regulations remains unaffected. The module descriptions (Appendix 1) govern the number of credit points that can be earned in each module and the detailed prerequisites for this.

§ 9
Student advisory service

(1) The general student advisory service is the responsibility of the Central Student Advisory Service of the TU Dresden and answers all questions regarding programmes offered, terms of enrolment and general student affairs. The subject-related advisory service within the framework of academic studies is the responsibility of the Faculty of Computer Science. This subject-related advisory service helps students, in particular, to tailor and plan their studies.

(2) Any students who have not yet earned an attestation by the beginning of the third semester

are obliged to seek advisory service.

§ 10
Adaptation of module descriptions

(1) A simplified procedure is used to adapt module descriptions to changed conditions to ensure optimum conditions for the programme. However, the fields “module name”, “contents and qualification aims”, “types of teaching and learning”, “prerequisites for earning credit points” as well as “credit points and grades” cannot be modified.

(2) In the simplified procedure, the Faculty Council, on the suggestion of the Academic Committee, decides on the modification of the module description. The modifications shall be communicated by the faculty via the usual channels.

§ 11
Coming into force and public notice

These Study Regulations become effective as of ***#Date#*** and are publicly announced in the Official Notices of the Technische Universität Dresden.

Issued on the basis of the decision of the Faculty Council of the Faculty of Computer Science of ***15.10.2014*** and the approval of the Rectorial Board of ***#Date#***.

Dresden, ***#date of isssue#***

The Rector
of the Technische Universität Dresden

Prof. Hans Müller-Steinhagen

Appendix 1a

Descriptions of mandatory modules

Module no.
DSE-M1
Module name
Systems Engineering
Responsible lecturer
Prof. Fetzer

Contents and qualification aims
Upon completion of the module, students will have become familiar with the basics of the design, development and operation of computer-based systems. They will have obtained a general idea of the structures of such systems, which usually consist of various hardware layers and software components. Most importantly, students will acquire the knowledge necessary to understand the non-functional aspects of systems, such as reliability and availability, and they will learn to employ procedures for the provision of these non-functional aspects. The students will come to understand fundamental aspects of the subject matter and to apply them in the course of their further studies.

Types of teaching and learning
The module consists of lectures of 4 class hours per week per semester and discussion sections of 4 class hours per week per semester as well as self-study.

Prerequisites for participation
Basic knowledge in the fields of systems architecture, modularisation and structuring of complex systems (at Bachelor level).
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is compulsory within the Master programme *Distributed Systems Engineering* and provides the fundamentals for the elective modules DSE-E6, DSE-E7 and DSE-E12.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of a written test of 120 minutes or an oral assessment of 30 minutes. The type of concrete assessment will be stipulated by the responsible lecturer at the beginning of the semester and made known by the faculty via the usual channels. Students are required to solve a set of exercises before taking the exam.

Credit points and grades
Students can earn 9 credit points through the module.
The module grade is equivalent to the grade given for the written test or for the oral assessment.

Frequency of the module
The module is offered each winter semester.

Workload
The workload comprises a total of 270 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-M2
Module name
Ubiquitous Systems
Responsible lecturer
Prof. Schill

Contents and qualification aims
Upon completion of the module, students will have learned to classify middleware architectures and platforms for the design of distributed applications and information systems. This applies to both the fields of mobile communication and mobile processing and to transaction processing in distributed environments. Students will be able to classify and develop concepts and architectures for distributed and omnipresent application and information systems, to choose the right solution and assess modern technological developments in the subject area.

Types of teaching and learning
The module consists of lectures of 4 class hours per week per semester and discussion sections of 2 class hours per week per semester as well as self-study.

Prerequisites for participation
Basic knowledge in the areas of computer networks (at Bachelor level).
For the independent acquisition of these prerequisites, see:
Tanenbaum, A.S.: *Computer Networks* (4th ed.).

Usability
The module is compulsory within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of two written tests of 60 minutes each or an oral assessment of 30 minutes. The type of concrete assessment will be stipulated by the responsible lecturer at the beginning of the semester and made known by the faculty via the usual channels.

Credit points and grades
Students can earn 7 credit points through the module.
The module grade is derived from the average of both written tests. Otherwise, it is equivalent to the grade given for the oral assessment.

Frequency of the module
The module is offered each winter semester.

Workload
The workload comprises a total of 210 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-M3
Module name
Transactional and Secure Platforms
Responsible lecturer
Prof. Lehner

Contents and qualification aims
Students who complete this module will be able to discuss further topics concerning the design of transactional information systems and distributed systems from the point of view of data security and to apply their knowledge in practical situations. They will acquire a basic understanding of data security in distributed systems and will learn how to solve problems in this area independently.

Types of teaching and learning
The module comprises lectures and discussion sections of 4 class hours per week per semester as well as self-study.

Prerequisites for participation
Basic knowledge in the areas of operating systems, computer architecture, databases and software engineering (at Bachelor level).
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is compulsory within the Master programme *Distributed Systems Engineering* and provides the fundamentals for the elective module DSE-E1.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of two separate tests. One test consists of a written test of 90 minutes or of an oral assessment of 30 minutes. The type of concrete assessment will be stipulated by the responsible lecturer at the beginning of the semester and made known by the faculty via the usual channels. Students are required to solve a set of exercises before taking the exam.

Credit points and grades
Students can earn 9 credit points through the module.
The module grade is derived from the average grades of the two separate tests.

Frequency of the module
The module is offered each winter semester.

Workload
The workload comprises a total of 270 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-M4
Module name
System Design
Responsible lecturer
Prof. Aßmann

Contents and qualification aims
Upon completion of the module, students will have learned how to apply basic methods, design elements and notations for the systematic development of large software systems as well as the methodology of modelling and simulating discrete event systems. The framework of the module is based on the software development process with its life-cycle models and phase models and, additionally, on the application of simulation and modelling techniques for the design of large and flexible application systems. Students who have completed the module will be able to assist in the development of large, consolidated, state-of-the-art software systems and to apply the methods of systems analysis to practical situations.

Types of teaching and learning
The module comprises lectures and discussion sections of 2 class hours per week per semester as well as self-study.

Prerequisites for participation
Fundamental and practical knowledge of the following technologies: the principle of object orientation, Java programming, UML modelling (class diagrams, state diagrams, sequence diagrams) (at Bachelor level).
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is compulsory within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of an oral assessment of 30 minutes and an internship.

Credit points and grades
Students can earn 5 credit points through the module.
The module grade is equivalent to the grade given for the oral assessment.

Frequency of the module
The module is offered each winter semester.

Workload
The workload comprises a total of 150 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-Int
Module name
Internship
Responsible lecturer
Prof. Fetzer

Contents and qualification aims
Upon completion of the module, students will be able to independently carry out individual research projects focusing on the practical application of the skills acquired during studies to distributed systems. They will learn to analyse complex tasks and to develop efficient solutions. This will enable them to understand and discuss practical situations which they will encounter later in the course of their professional careers and to find practical solutions.

Types of teaching and learning
The module consists of laboratory classes of 8 class hours per week per semester.

Prerequisites for participation
Mastery of the fundamentals and scientific methods of *Distributed Systems Engineering* in accordance with the mandatory modules DSE-M1 to DSE-M4.

Usability
The module is compulsory within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists either of two internships of 180 hours each or of an internship of 240 hours along with relevant seminar work of 120 hours.

Credit points and grades
Students can earn 12 credit points through the module.
No grade is given for the module and it is assessed with either “passed” or “failed”.

Frequency of the module
The module is offered in each semester.

Workload
The workload comprises a total of 360 hours.

Duration of the module
The module lasts one semester.

Appendix 1b

Descriptions of elective modules

Module no.
DSE-E1
Module name
Advanced Security and Cryptography
Responsible lecturer
Prof. Strufe

Contents and qualification aims
Upon successful completion of this module, students will have learned to discuss general aspects of security and, in particular, the multilateral security aspects of IT systems and to identify aspects that should be protected and their dependency on one other. They will be able to classify attack models and various security mechanisms and will know how to evaluate cryptosystems as the fundamental security mechanisms providing confidentiality and integrity. Students will be able to analyse the security factors of IT systems in two ways. Which security precautions are necessary? And how can maximum security against attacks be ensured? On completion of the module, students will also have acquired the basic knowledge and skills necessary for the development of IT systems.

Types of teaching and learning
The module comprises lectures and discussion sections of 2 class hours per week per semester as well as self-study.

Prerequisites for participation
Fundamental knowledge of data security issues in accordance with module DSE-M3.
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is an elective module within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of an oral assessment of 30 minutes. Students are required to solve a set of exercises before taking the exam.

Credit points and grades
Students can earn 6 credit points through the module.
The module grade is equivalent to the grade given for the oral assessment.

Frequency of the module
The module is offered each summer semester.

Workload
The workload comprises a total of 180 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-E2
Module name
Wireless Sensor Networks
Responsible lecturer
Prof. Schill

Contents and qualification aims
Upon successful completion of this module, students will have become familiar with the fields of *Ubiquitous Computing* and *Wireless Sensor Networks* and will be able to competently discuss topics such as the application of wireless sensor networks and their main components. They will understand the typical aspects of sensor networks, such as energy consumption, communication, processing within the network and self-organisation. They will be able to understand algorithms in terms of link building and media access control in wireless sensor networks and to design them independently. Since a wireless sensor network is a distributed network, students will also learn to master issues such as time synchronization, topology control and data aggregation. They will become familiar with routing techniques and query distribution. Students will be able to examine and discuss open questions and problems in the field of wireless sensor networks as a whole.

Types of teaching and learning
The module comprises lectures and seminars of 2 class hours per week per semester as well as self-study.

Prerequisites for participation
Basic knowledge in the areas of computer architecture, distributed systems, mobile communication and software engineering (at Bachelor level).
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is an elective module within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of a written test of 60 minutes or an oral assessment of 30 minutes. The type of concrete assessment will be stipulated by the responsible lecturer at the beginning of the semester and made known by the faculty via the usual channels.

Credit points and grades
Students can earn 6 credit points through the module.
The module grade is equivalent to the grade given for the written test or for the oral assessment.

Frequency of the module
The module is offered each summer semester.

Workload
The workload comprises a total of 180 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-E3
Module name
Distributed Operating Systems
Responsible lecturer
Prof. Härtig

Contents and qualification aims
Upon completion of this module, students will have learned to independently solve complex problems concerning the design of distributed systems, to analyse case studies and to make comparisons with other projects in order to identify potential critical issues. They will be able to justify and defend their analysis in the context of critical discussion.
Furthermore, students will become familiar with topics such as scalability, fault tolerance, security and robustness and will be able to see issues such as database development and computer architecture in context. On the basis of their broad knowledge, students will also be able to evaluate and discuss latest developments.

Types of teaching and learning
The module comprises lectures of 2 class hours per week per semester, discussion sections and seminars of 1 class hour per week per semester as well as self-study.

Prerequisites for participation
Understanding of the fundamentals of operating systems (at Bachelor level).
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is an elective module within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of a written test of 60 minutes or an oral assessment of 30 minutes. The type of concrete assessment will be stipulated by the responsible lecturer at the beginning of the semester and made known by the faculty via the usual channels.

Credit points and grades
Students can earn 6 credit points through the module.
The module grade is equivalent to the grade given for the written test or for the oral assessment.

Frequency of the module
The module is offered each summer semester.

Workload
The workload comprises a total of 180 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-E4
Module name
Component-Based Software Engineering
Responsible lecturer
Prof. Aßmann

Contents and qualification aims
Upon successful completion of this module, students will be able to confront the challenges of modern complex software systems using a component-based development concept. They will learn how to construct applications in a step-by-step manner using independent components and how to increase their flexibility. By means of practical exercises, they will also be able to solve realistic tasks and to tackle any new challenges on the basis of their sound fundamental skills.

Types of teaching and learning
The module comprises lectures and discussion sections of 2 class hours per week per semester as well as self-study.

Prerequisites for participation
Fundamental and practical knowledge of the following technologies: the principle of object orientation, Java programming, UML modelling (class diagrams, state diagrams, sequence diagrams) at Bachelor level.
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is an elective module within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of a written test of 90 minutes or an oral assessment of 30 minutes. The type of concrete assessment will be stipulated by the responsible lecturer at the beginning of the semester and made known by the faculty via the usual channels. Students are required to solve a set of exercises before taking the exam.

Credit points and grades
Students can earn 6 credit points through the module.
The module grade is equivalent to the grade given for the written test or for the oral assessment.

Frequency of the module
The module is offered each summer semester.

Workload
The workload comprises a total of 180 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-E5
Module name
Selected Areas of Internet-based Systems
Responsible lecturer
Prof. Schill

Contents and qualification aims
Upon completion of this module, students will have learned to understand and discuss the general technologies and protocols of the Internet and of related mobile and distributed system solutions, as well as their technical basis and methodological principles. This includes the interactive Web, semantic web-technologies, peer-to-peer systems, mobile and ubiquitous applications as well as the relevant special network technologies.

Types of teaching and learning
The module comprises lectures and discussion sections of 4 class hours per week per semester as well as self-study.

Prerequisites for participation
Fundamental knowledge of the areas of computer architecture, distributed systems, mobile communication and software engineering (at Bachelor level).
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is an elective module within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of two written tests of 60 minutes each or an oral assessment of 30 minutes. The type of concrete assessment will be stipulated by the responsible lecturer at the beginning of the semester and made known by the faculty via the usual channels.

Credit points and grades
Students can earn 12 credit points through the module.
The module grade is derived from the average of the written tests. Otherwise, it is equivalent to the grade of the oral assessment.

Frequency of the module
The module is offered each academic year, beginning in the summer semester.

Workload
The workload comprises a total of 360 hours.

Duration of the module
The module lasts two semesters.

Module no.
DSE-E6
Module name
Concurrent and Distributed Systems
Responsible lecturer
Prof. Fetzer

Contents and qualification aims
Upon completion of this module, students will be able to analyse and evaluate the latest developments in *Computational Engineering*. The students will learn to use scientific working methods and research techniques and will be able to work on tasks using the available literature, documentation and various other sources. They will also be able to defend their analysis in the context of critical discussion.
Moreover, students will acquire a good understanding of the fundamentals of concurrent and distributed systems, which are necessary for the design and operation of concurrent and distributed applications. They will be able to work with transactional memory systems, which will be supported by most CPUs in the future. This enables them to develop concurrent and distributed systems and to analyse their functionality independently.

Types of teaching and learning
The module comprises lectures and laboratory hours of 4 class hours per week per semester, as well as self-study.

Prerequisites for participation
The knowledge and skills acquired in the mandatory module DSE-M1. Students should have already acquired a basic knowledge of multiprocessor programming (at Bachelor level).
For the independent acquisition of these prerequisites, see:
Herlihy, M. & N. Shavit: *The Art of Multiprocessor Programming*.

Usability
The module is an elective module within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of a internship of 120 hours as well as a written test of 60 minutes or an oral assessment of 30 minutes. The type of concrete assessment will be stipulated by the responsible lecturer at the beginning of the semester and made known by the faculty via the usual channels. Students are required to solve a set of exercises before taking the written test or for the oral assessment exam.

Credit points and grades
Students can earn 12 credit points through the module.
The module grade is equivalent to the grade given for the written test or for the oral assessment.

Frequency of the module
The module is offered each summer semester.

Workload
The workload comprises a total of 360 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-E7
Module name
Software Fault Tolerance
Responsible lecturer
Prof. Fetzer

Contents and qualification aims
Graduates of this module will be able to develop and use mechanisms and system designs that address system faults in distributed systems during runtime, which occur at above-average frequency as software faults. They will acquire the necessary expertise in fault tolerance and will be able to use their knowledge to discuss and evaluate current scientific work in this field.
By the end of the module, students will also have acquired the practical skills necessary to analyse and eliminate faults in concrete application situations. Furthermore, they will be able to apply the skills acquired in the module to new, unknown situations and to develop efficient, practical solutions.

Types of teaching and learning
The module comprises lectures, discussion sections and seminars of 2 class hours per week per semester, laboratory classes of 4 class hours per week per semester as well as self-study.

Prerequisites for participation
The knowledge and skills acquired in the mandatory module DSE-M1.
Participants should be familiar with the fundamentals of the design, development and operation of computer-based systems (at Bachelor level).
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is an elective module within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of an internship of 120 hours, seminar work of 60 hours, as well as a written test of 60 minutes or an oral assessment of 30 minutes. The type of concrete assessment will be stipulated by the responsible lecturer at the beginning of the semester and made known by the faculty via the usual channels. Students are required to solve a set of exercises before taking the written test or the oral assessment.

Credit points and grades
Students can earn 15 credit points through the module.
The module grade is equivalent to the grade given for the written test or for the oral assessment.

Frequency of the module
The module is offered in each academic year, beginning in the summer semester.

Workload
The workload comprises a total of 450 hours.

Duration of the module
The module lasts two semesters.

Module no.
DSE-E8
Module name
Microkernel-Based Operating Systems
Responsible lecturer
Prof. Härtig

Contents and qualification aims
Upon completion of this module, students will have acquired a broad knowledge of *microkernels*, i.e., those small OS kernels on which operating systems can be flexibly built. Students will be able to use these *microkernels* in safety-critical or embedded applications as well as in real-time systems to provide a small system kernel for critical tasks. Furthermore, they will be able to use them to design well-structured operating systems for a wide range of tasks. In the course of practical experiments, students will learn to understand basic principles and to use them to solve problems independently. They will become familiar with CPU data structures, system calls, virtual memory management, communication between processes, virtualisation as well as portability. They will know how to design operating systems, manage the memory at the highest level, synchronise, and will be familiar with interface description languages, software drivers, the use of Linux with microkernels as well as real-time operating systems and secure operating systems.

Types of teaching and learning
The module comprises lectures of 2 class hours per week per semester and discussion sections of 1 class hour per week per semester as well as self-study.

Prerequisites for participation
Basic knowledge of operating systems, computer architecture and software engineering. Knowledge of the programming language C or C++ (at Bachelor level).
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is an elective module within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of a written test of 60 minutes or an oral assessment of 30 minutes. The type of concrete assessment will be stipulated by the responsible lecturer at the beginning of the semester and made known by the faculty via the usual channels.

Credit points and grades
Students can earn 6 credit points through the module.
The module grade is equivalent to the grade given for the written test or for the oral assessment.

Frequency of the module
The module is offered each winter semester.

Workload
The workload comprises a total of 180 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-E9
Module name
Real-Time Systems
Responsible lecturer
Prof. Härtig

Contents and qualification aims
Upon successful completion of the module, students will have learned to classify, model and assess real-time-systems, i.e., systems whose correct functioning depends on complying with operational deadlines. This includes the fundamentals of load and resources, time, clocks and clock synchronisation, time-controlled vs. event-controlled design and scheduling methods. On the basis of these skills, students will understand related and advanced topics such as real-time programming languages (synchronous and event-controlled), real-time OS, real-time systems and hardware, microcontrollers, caches, real-time communication in field buses and wide area networks and the general applications of real-time systems. With this broad knowledge, students will be able to examine real-time systems from a holistic perspective.

Types of teaching and learning
The module comprises lectures of 2 class hours per week per semester and discussion sections of 1 class hour per week per semester as well as self-study.

Prerequisites for participation
Basic knowledge in the fields of operating systems, computer architecture, databases and software engineering (at Bachelor level).
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is an elective module within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of a written test of 60 minutes or an oral assessment of 30 minutes. The type of concrete assessment will be stipulated by the responsible lecturer at the beginning of the semester and made known by the faculty via the usual channels.

Credit points and grades
Students can earn 6 credit points through the module.
The module grade is equivalent to the grade given for the written test or for the oral assessment.

Frequency of the module
The module is offered each winter semester.

Workload
The workload comprises a total of 180 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-E10
Module name
Application Development for
Mobile & Ubiquitous Computing
Responsible lecturer
Prof. Schill

Contents and qualification aims
Upon completion of this module, students will be able to discuss mobile computer applications and their implementation. They will be familiar with fields such as *ambient intelligence* and *ubiquitous computing* and they will have learned to classify various functionalities, such as network aspects (different communication capacities for short and long distances) and special mobile computer concepts (e.g. disconnected and autonomous operation, mobile agents and context-based adaptation). They will be able to design and implement different architectures for mobile, distributed systems and they will be familiar with communication aspects, local and distributed platforms (e.g., OSGi, J2ME, J2EE) as well as graphic interfaces. Students will also learn about other concepts, such as mobile security, data synchronisation, the adaptation of applications to the specific needs of mobile devices as well as databases for mobile devices, location-based services, the Semantic Web and autonomous behaviour. They will be able to apply tools, environments, platforms and emulators in specific situations and will be up-to-date on international research in the field.

Types of teaching and learning
The module comprises lectures and discussion sections of 2 class hours per week per semester as well as self-study.

Prerequisites for participation
Fundamental knowledge in the areas of computer architecture, distributed systems, mobile communication and software engineering (at Bachelor level).
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is an elective module within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of an internship of 60 hours as well as an oral assessment of 30 minutes.

Credit points and grades
Students can earn 6 credit points through the module.
The module grade is equivalent to the grade given for the oral assessment.

Frequency of the module
The module is offered each winter semester.

Workload
The workload comprises a total of 180 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-E11
Module name
Principles of Dependable Systems
Responsible lecturer
Prof. Fetzer

Contents and qualification aims
Upon successful completion of this module, students will have learned to design and implement extremely reliable and secure systems. They will acquire special knowledge in the design of distributed protocols for critical systems because of the great number of possible error and failure types in this field. On the basis of their theoretical knowledge, students will develop efficient solutions for practical situations.

Types of teaching and learning
The module comprises lectures, discussion sections and seminars of 2 class hours per week per semester as well as self-study.

Prerequisites for participation
The knowledge and skills acquired in the mandatory module DSE-M1. Participants should be familiar with the fundamentals of the design, development and operation of computer-based systems (at Bachelor level).
For the independent acquisition of these prerequisites, search the sources given at this website: ***http://dse.inf.tu-dresden.de/*.**

Usability
The module is an elective module within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of seminar work of 60 hours as well as a written test of 60 minutes or an oral assessment of 30 minutes. The type of concrete assessment will be stipulated by the responsible lecturer at the beginning of the semester and made known by the faculty via the usual channels. Students are required to solve a set of exercises before taking the written test or the oral assessment.

Credit points and grades
Students can earn 9 credit points through the module.
The module grade is equivalent to the grade given for the written test or for the oral assessment.

Frequency of the module
The module is offered each winter semester.

Workload
The workload comprises a total of 270 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-E12
Module name
Foundations of Computational Logic
Responsible lecturer
Prof. Hölldobler

Contents and qualification aims
The contents of the module include propositional logic, first-order logic, equational logic, deductive, abductive and inductive logic, non-monotonic logic, machine learning, logic-based programme development, processing of natural speech and neuro-symbolic integration. Upon completion of the module, students will have acquired the methodological basics of propositional logic and first-order logic. They will acquire broad knowledge in the specialist field of computational logic as well as of the basic techniques and methods used in important subsidiary fields.

Types of teaching and learning
The module comprises lectures and discussion sections of 4 class hours per week per semester as well as self-study.

Prerequisites for participation
Fundamental knowledge in the areas of theoretical computer science (at Bachelor level).
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is an elective module within the Master programme *Distributed Systems Engineering* and a mandatory module in the Master programme *Computational Logic (MCL-F).*

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of a written test of 90 minutes and an oral assessment of 20 minutes.

Credit points and grades
Students can earn 9 credit points through the module.
The module grade is derived from the average of the grades given for the individual assessments.

Frequency of the module
The module is offered each winter semester.

Workload
The workload comprises a total of 270 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-E13
Module name
Advanced Topics in Systems Architecture
Responsible lecturer
Chairperson of the Examination Committee

Contents and qualification aims
Upon successful completion of this module, students will have acquired technical, methodological, practical and interdisciplinary skills and will possess the preliminary skills needed to investigate a theoretical aspect of systems architecture of their own choosing, as well as to identify and to solve problems both as part of a team and in individual analysis.

Types of teaching and learning
The module comprises lectures, discussion sections, internships and seminars of 2 class hours per week per semester as well as self-study.
The courses in the given extent are to be selected from the programme catalogue DSE-A. The faculty will inform students about this catalogue and about the required assessments via the usual channels at the beginning of the semester.

Prerequisites for participation
Knowledge and skills in the area of systems architecture are required. In particular, participants should be familiar with the fundamentals of the design, development and operation of computer-based systems (at Bachelor level).
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is an elective module within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam. The module exam consists of the assessments as specified in catalogue DSE-A.

Credit points and grades
Students can earn 3 credit points through the module.
The module grade is equivalent to the grade given for the assessment.

Frequency of the module
The module is offered each winter semester.

Workload
The workload comprises a total of 90 hours.

Duration of the module
The module lasts one semester.

Module no.
DSE-E14
Module name
Advanced Topics in Distributed Systems
Responsible lecturer
Chairperson of the Examination Committee

Contents and qualification aims
Upon successful completion of this module, the students will have acquired technical, methodological, practical and interdisciplinary skills and will possess the preliminary skills need to investigate a theoretical aspect of distributed systems of their own choosing, as well as to identify and to solve problems both as part of a team and in individual analysis.

Types of teaching and learning
The module comprises lectures, discussion sections, internships and seminars of 4 class hours per week per semester as well as self-study.
The courses in the given extent are to be selected from the programme catalogue DSE-A. The faculty will inform students about this catalogue and about the required assessments via the usual channels at the beginning of the semester.

Prerequisites for participation
Knowledge and skills in the area of distributed systems are required (at Bachelor level).
For the independent acquisition of these prerequisites, search the sources given at this website: http://dse.inf.tu-dresden.de/.

Usability
The module is an elective module within the Master programme *Distributed Systems Engineering*.

Prerequisites for earning credits
Students earn credit points after having passed the module exam.
The module exam consists of the exam as specified in catalogue DSE-A.

Credit points and grades
Students can earn 6 credit points through the module.
The module grade is derived from the unweighted average of the grades given for the assessments.

Frequency of the module
The module is offered each winter semester.

Workload
The workload comprises a total of 180 hours.

Duration of the module
The module lasts one semester.