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**Examination regulations for the Master's degree course in Computer Engineering of the Faculty for Electrical Engineering, Computer Science and Mathematics at the University of Paderborn**

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Based on § 2 section 4 and § 64 section 1 of the law of the Universities of the state North–Rhine Westphalia (Higher Education Act – HEA) of September 16<sup>th</sup> 2014 (GV.NRW. p. 547), last changed by the law of December 15<sup>th</sup> 2016 (GV.NRW. p. 1154), the University of Paderborn has issued the following regulations:

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## **I. General Issues**

### **§1. Purpose of the exams, aim and duration of studies**

(1) The master's exam builds a second professional university degree of the studies of Computer Engineering.

(2) The Master's exam shall examine whether the students have extended the necessary knowledge and deepened it in chosen areas for the work experience in a previous Bachelor study program, so they have the ability to use suitable scientific methods to solve problems in Computer Engineering and develop it in their chosen field of academic specialisation. To the requirements of the work experience in Computer Engineering also belongs the ability of communicating in English language orally and in written form in professional activities.

(3) The course of studies delivers the students not only the general aims of studies of § 58 HG the ability to use and develop scientific methods of Computer Engineering in their work and, concerning the effects of technological change, to act responsible.

### **§2. Academic degree**

When the master's degree program is completed successfully, the faculty for Electrical Engineering, Computer Science and Mathematics confers the academic degree "Master of Science", abbreviated "M.Sc.". If, according to § 10 paragraph 7, examination performances have been made in English language in a sufficient scope, the degree "master's degree program in English language" will be certified on the certificate.

### **§3. Beginning of studies**

Beginning of studies is in the winter term or summer term.

### **§4. Start of studies, licensing requirements and academic qualification**

(1) In the Master program Computer Engineering can only be inscribed who cumulatively

1. Has the A–level certificate (in general or connected to a subject) or according to a legislative decree an advanced technical college certificate or one through a legal regulation or an educational qualification approved as equal by the responsible public authority or has the requirements for the qualified in a professional education or meets the requirements of the regulation of university access for foreign national with university entry qualifications.

2. Has a qualification which fulfils the following requirements:

a) It must involve a first higher education degree qualifying for entering a profession with a normal program length of at least six semesters at the University of Paderborn or a public or publicly accepted university or a state or state–approved university of cooperative education. Qualifications of a foreign state or state–approved university ensure an access, as long as regarding the gained competences there is no significant difference to a qualification of the University of Paderborn according to paragraph 1.

For foreign educational attainments equivalency agreements approved by the Standing Conference of the State Ministers of Education and the Arts in the Federal Republic of Germany and the Conference of Presidents and Rectors of Universities and Other Higher Education Institutions or corresponding legal regulations have to be taken into account. As far as agreements of the Federal Republic of Germany made with other states about the equivalency in the higher education sector (equivalence treaty) favour students from foreign states differing from paragraph 2, regulations of the equivalence treaty come first. Apart from that, in case of doubts about presence or absence of significant differences the central office for foreign education has to be consulted. The examination board makes the statement about the requirements according to paragraph 2.

b) The qualification has to be gained in the bachelor's degree program Computer Engineering at the University of Paderborn or it must be a qualification, which includes at least the following achievements:

- 20 CP in the field of Mathematics

- 30 CP in the field of Computer Science, whereby especially topics of Electrical Computer Science must be covered

- 30 CP in the field of Electrical Engineering

- 12 CP for an individual dissertation

If 30 credit points are missing from the fields Mathematics and Computer Science, then enrolment can take place under the condition that the requirements have to be caught up on throughout adequate studies within up to three obligation courses and approved by passing the corresponding examinations. The examination board is responsible for the statement about the requirements. The examinations have to be taken within the first two semesters of the master's degree program. These have to be proved at the registration to the master's dissertation. A list of possible obligation courses can be found in appendix C.

3. Has sufficient language skills according to paragraphs 2 and 3.

4. As a foreign prospective student who isn't on an equal footing with German according to international law attests his or her ability to study throughout the results of GRE Revised General Test. Usually at least 157 points are required in the part "Quantitative Reasoning" at least 4.0 points in the part "Analytical Writing" of the GRE Revised General Test. When there is an excellent grade in the qualification according to No. 2, the examination board can accept a lower number of points, depending on the qualification.

Prospective students with a German eligibility for entry to higher education are exempted from the proof of the ability to study.

(2) To the master's degree program Computer Engineering will be admitted who

1. Has language skills in English which can be proved through transcripts or documents of

(a) A successfully completed school instruction in English language from grade 5 and a duration of at least 5 years – as developing nations – or

(b) A language test at least on the level TOEFL 500 (paper and pencil) or TOEFL 61 (Internet based) or

(c) Equivalent skills (e.g. Cambridge First Certificate (FCE) grade B or IELTS with a minimum result 5.0)

2. As a student who has acquired her or hers entry requirements not at a German facility has sufficient skills in German language. A verification of the linguistic ability to study is needed for unlimited admission or enrolment to all study programs. Details are governed by the regulations for the German language examination for enrolment at university at the University of Paderborn in the respective current version.

(3) Alternatively to paragraph 2 also someone who doesn't have the necessary German language skills, but has profound English language skills instead, which can be proved by certificates or documents of

1. A bachelor's degree in an English speaking foreign country<sup>1</sup> or in an English speaking, accredited, national degree program or

2. A test of English as Foreign Language (TOEFL) "Internet-based" Test (iBT) with a result of at least 80 points or

3. A TOEFL "Paper-based" test (PBT) with a result of at least 550 points or

4. An IELTS-test with a result of at least 6.5 or

5. A Cambridge Test – Certificate in Advanced English (CAE) grade B or tests on an equivalent level.

(4) Enrolment is to be declined, if

1. The conditions mentioned in paragraph 1 – 3 aren't fulfilled or when

2. The candidate has finally failed an examination, which is essential according to the examination regulations, in the degree program wanted at an university within the scope of the basic law or

3. The candidate has finally failed an examination, which is essential according to the examination regulations, in a degree program at an university within the scope of the basic law, if the unsuccessful degree program has an essential content-related similarity to the master's degree course Computer Engineering at the University of Paderborn. The examination board decides about the essential content-related similarity.

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<sup>1</sup> Within the frame of these regulations these are Australia, Great Britain, Ireland, Canada, New Zealand and the United States of America.

## **§5. Prescribed period of study and extend of studies**

(1) The normal program length for the master's degree program takes including the master's examination four semesters. Students are expected to have a workload of around 3 600 hours, equivalent to 120 credit points (CP).

(2) Studies cover modules with an overall scope of 120 credit points, which include mandatory modules with a scope of 24 credit points, compulsory elective module with a scope of 42 credit points, a module called Scientific Working with a scope of 6 credit points, a two-semester project module with a scope of 18 credit points and the module Dissertation with a scope of 30 credit points.

(3) Credit points are awarded according to the European Credit Transfer System (ECTS). A credit point equals a workload of 30 hours on average. A semester usually includes 30 CP and consequently an amount of work of 900 hours.

(4) The faculty for Electrical Engineering, Computer Science and Mathematics has created an exemplary timetable and a module guide on the basis of these examination regulations. These documents describe in detail the aims and content of the modules, assigned courses, as well as suggested prior knowledge. The exemplary timetable and the list of modules can be found in this examination regulation in the appendix A, B and C. The module guide informs about the current status of the examination regulations of the resolution. The module guide is updated on a regular basis and published on the Internet sites of the faculty for Electrical Engineering, Computer Science and Mathematics.

(5) Course contents described in the module guide are chosen and limited in a way which helps to complete the studies in normal program length.

(6) If the master's degree program Computer Engineering is studied completely in English language, a small restriction in freedom of choice has to be taken into account. The same counts for the required amount of courses mentioned in § 10 paragraph 7 are chosen in English.

## **§6. Modules**

(1) The master's degree program Computer Engineering is offered in a modularised form. Modules are thematically and temporally rounded, concluded in themselves and equipped with credit points, independent units of qualification, which can be examined. Modules have a scope of 6 – 18 CP (without the thesis module). Those can usually be completed within one to two semesters.

(2) Besides the modules Project Group (18 CP) and the master's thesis (30 CP) the master's degree program is divided into mandatory modules (24 CP), compulsory elective modules (42 CP) as well as a module called Scientific Working (6 CP). The compulsory options contain six consolidation areas for which there are corresponding module catalogues in the module guide; the examination board is responsible for the development of those consolidation areas. Compulsory elective modules with a scope of 24 credit points must be chosen from one of the six consolidation areas (consolidation in studies); more compulsory elective modules with the scope of 18 credit points may be chosen arbitrary from six areas of academic specialisation, so that 42 credit points are reached in total. The module Scientific Working contains a seminar with the scope of 4 CP as well as one course, which is free to choose, with a scope of 2 CP; details are regulated in appendix B and the module description.

(3) If a module contains compulsory elective courses, those have to be chosen from course catalogue, which is part of the module description.

## **§7. Accreditation of achievements**

(1) Achievements which have been rendered in other degree programs or in degree programs at other state or state–approved universities, at state or state–approved colleges of cooperative education or in degree programs at foreign state or stately accepted universities are accepted on application, as long as concerning the gained competences there is no major difference compared to the achievements which will be replaced. Not a schematic comparison has to be made, but an overall consideration regarding the accreditation purpose of the continuation of studies and taking exams. Paragraphs 1 and 2 count for the accreditation of achievements made via stately accepted distance learning or for distance learning units created by the state North–Rhine Westphalia in this context with other states and the federal government.

(2) For the accreditation of achievements at foreign universities the equivalency agreements made by the Standing Conference of the State Ministers of Education and the Arts in the Federal Republic of Germany and the Conference of Presidents and Rectors of Universities and Other Higher Education Institutions as well as the agreements within the university partnerships have to be kept in mind. Insofar agreements of the Federal Republic of Germany have been made with other states in the higher education sector (equivalency agreements) favouring students of foreign states differing from paragraph 1 regulations of the equivalency agreements come first. Otherwise when there are doubts about presence or absence of significant differences one has to obey the central office for foreign education.

(3) The examination board has to place a student on the student's request into a semester on the basis of accreditation according to paragraph 1.

(4) Knowledge and skills proven in the entrance examination of prospective students, who are qualified to begin their studies on the basis of an entrance examination according to § 49 paragraph 12 HG, will be accepted. For the examination board it is obligatory to note down the entrance examination in the certificate.

(5) Other skills and qualifications can be accepted on application by the examination board on the basis of submitted documents, if those skills and qualifications are equivalent in content and level to the achievements which are supposed to be replaced.

(6) The examination board is responsible for accreditations according to paragraphs 1 and 5. Before assessment about presence or absence of significant differences or of equivalence responsible expert representatives have to be consulted. A denial of the assessment is to be explained.

(7) The applicant has to submit the information needed for accreditation (especially knowledge and skills gained through achievements and examination results) in a form determined by the examination board. The examination board has to decide about applications according to paragraph 1 within ten weeks the latest after a complete submission of all relevant information.

(8) The accreditation will be marked in the certificate. When achievements are accredited grades have to be taken over after a conversion, if necessary, and to be taken into the respective grade calculation, as far as the grading systems are comparable. If there is no grade or if the grading systems aren't comparable, the note "passed" is chosen.

(9) An achievement can only be approved once. This also counts for assessment of other knowledge and qualifications.

## **II. Organisation of the examinations**

### **§8. Examination board**

(1) The faculty executive committee of the faculty for Electrical Engineering, Computer Science and Mathematics builds an examination board for the master's degree course Computer Engineering. The responsibility lies in

1. The organisation of examinations and the supervision of its implementation.
2. The compliance of the examination regulations and the consideration the procedure regulations made for implementation of the examinations.
3. Decisions about contradictions against decisions made in an assessment procedure.
4. Writing an annual report for the faculty executive committee about the development of examinations and program length.
5. Other tasks clearly assigned to the examination board by these regulations.

Subject-specific decisions (e.g. accreditation of achievements) require the examination board to get the expertise of the responsible expert representatives.

(3) The examination board consists of representatives of the institute for Electrical Engineering and Information Engineering and the institute for Computer Science. It consists of the chairperson, the representative chairperson and five more members. On a proposal from the respective group the chairperson, the representative chairperson, two more members from the group of professors, one member from the group of the academic staff and two members from the group of students are elected by their respective representatives in the faculty executive committee. Accordingly representatives are elected for the members of the examination board except for the chairperson and the representative chairperson. The participation of the institutes, the chairperson and terms of office are regulated as following:

1. In the group of professors each of the two members and their representatives come from the participating institutes. No 2 remains untouched.
2. The chairperson exchanges from term of office to term of office of members from the group of the professors between the participating institutes (rotation). The representative chairperson has to be from the other institute.
3. The academic staff member comes from the institute, which doesn't provide the chairperson.
4. The term of office of the members from the group of professors and from the group of the academic staff members lasts two years and goes from October 1<sup>st</sup> of the election year of the examination board until September 30<sup>th</sup> of the following year. Re-election is permitted. Regulations concerning the gender equality in composition according to § 11 c HG have to be respected.

- (4) The examination board is the authority in case of administrative procedural law.
- (5) The examination board is quorate when besides the chairperson or the representative chairperson and two more professors at least one more voting member is present. The examination board resolves with a simple majority. When there is a tie vote then the vote of the chairperson counts. When pedagogical–scientific decisions have to be made, especially concerning evaluation and accreditation of achievements, the student members of the examination board have only an advisory voice.
- (6) The examination board is summoned by the chairperson. The convocation has to be made when at least three members request it.
- (7) The meetings of the examination board aren't public. The members of the examination board, its representatives, the examiners and assessors underlie the official secrecy. As far as they aren't in the public service they are obligated to secrecy by the chairperson of the examination board.
- (8) Members of the examination board have the right to attend the approval of examinations.

### **§9. Examiners and assessors**

- (1) The examination board appoints the examiners and assessors. The appointment can be assigned to the chairperson. All examiners are independent teachers of courses in which according to the curriculum and the module descriptions performances can be provided. Someone who has taken at least the equivalent master's examination or a comparable examination can be appointed as an assessor.
- (2) Examiners are independent in their audit activity.
- (3) The candidate can suggest examiners for the master's dissertation and for the oral examinations, if several examiners can be chosen from. Suggestions of the candidate shall be taken into account if possible. A legal claim doesn't result from it.
- (4) The examination board ensures that the candidate finds out about the examiners on time, usually four, at least two weeks before the date of the particular examination, via the Campus Management System of the University of Paderborn.

## **III. Examinations**

### **§10. Aim, word limit and style of Master's examination**

The candidate has to prove throughout the master's examination that she or he has acquired the necessary basis for Computer Engineering, a methodical range of means, a systematic orientation and on this basis a wide spectrum of general scientific knowledge in engineering and computer science.

- (1) The master's examination consists of

1. Study–related module examinations about contents of modules with a scope of 66 credit points,
2. The module Project Group (18 CP)
3. The module Scientific Working (6 CP) and



4. The module dissertation (30 CP).

(2) Module examinations concurrently with the course about the content of the following compulsory modules with the indicated credit points have to be taken:

1. Compulsory Module Computer Science I (6 CP)
2. Compulsory Module Computer Science II (6 CP)
3. Compulsory Module Electrical Engineering I (6 CP)
4. Compulsory Module Electrical Engineering II (6 CP)

(3) The compulsory options are divided into six consolidation areas:

1. Embedded Systems
2. Nano / Microelectronics
3. Computer Systems
4. Communication and Networks
5. Signal, Image and Speech Processing
6. Control and Automation

(4) Compulsory elective modules with a scope of 24 credit points must be chosen from one of the consolidation areas. Furthermore other compulsory elective modules of a scope of 18 credit points must be completed whereby it can be chosen from all consolidation areas. In total 42 credit points must be accomplished in the compulsory options.

(5) The catalogue of the courses of the compulsory elective modules as well as more concrete regulations of the examinations form of the compulsory and the compulsory elective modules can be found in the list of modules in appendix B.

(6) All students must complete modules and the associated examinations with the scope of at least 24 credit points in English language. This means within these regulations that lectures and materials are kept or rather are available in English language and examinations are held in English language.

(7) The certificate according to § 2 of the university degree in "English-speaking master's degree course Computer Engineering" will be given if

1. The examination according to paragraph 1 N° 4 (thesis module) has been completely done in English language and

2. Such have been completed according to paragraph 1 N° 1 until 3 and according to the form described in paragraph 7, with exception of the modules and examinations with the scope of not more than 18 credit points and with exception of non-English language courses in the module Scientific Working.

## **§11. Admission to the Master's exam**

(1) Only those who are enrolled at the University of Paderborn for the master's degree course Computer Engineering or are permitted as visiting student according to § 52 HG can be permitted to examinations in the master's degree course Computer Engineering.

(2) According to available capacities and on application at the examination board students of the bachelor's degree course Computer Engineering, who have gained at least 152 credit points in their bachelor's degree course in a first completed stage of stage of study and have registered their bachelor's thesis and probably will fulfil the entry requirements for the master's degree course Computer Engineering, will be permitted to the modules of the master's degree course Computer Engineering with the scope of 30 credit points for one semester beyond paragraph 1.

(3) The module dissertation can only be started when modules with the scope of 45 credit points are successfully completed. In case of enrolment upon which conditions may be placed according to § 4 it must be proven in addition to having passed the related examinations.

(4) The registration of the Master's thesis has to be sent to the examination board in written form via the central examination office. A proof of the presence of the entry requirements mentioned in paragraph 3 has to be added to the registration.

(5) Admission is to be declined when the conditions named in paragraphs 1 and 3 aren't fulfilled.

## **§12. Enrolment and registration deadline**

(1) For every module a registration at the Campus Management System of the University of Paderborn is necessary. The registration can only be done when the entry requirements are fulfilled.

(2) For every examination a separate registration at the Campus Management System of the University of Paderborn is necessary. The registration is made within the time period announced by the Campus Management System. Examinations can be taken as soon as the achievements needed for admission are proven.

## **§13. Completion of a module**

(1) Every module is completed by a module examination and probably scheduled qualified participation. The module examination takes place in temporal relation with the module. A module examination usually consists of an examination in the end of the module ("Modulabschlussprüfung"). The module examination can also consist of several partial examinations ("Modulteilprüfung"). If a module consists of several partial examinations, every partial examination has to be passed. The grade of the module equals the grade reached in the module examination.

(2) Credit points can only be gained when the module has been successfully completed. The module is successfully completed when the examination in the end of a module has been at least marked with a "sufficient" and the possibly required qualified participations have been accomplished.

#### **§14. Examination performances in modules**

(1) In modules examination performances are rendered according to the module descriptions. The grades of the module examinations flow into the final grade of the master's examination. These will be counted in accordance with the acquired credit points except for the project group module and the thesis module (cf. § 19).

(2) If there are framework specifications about the form and / or duration / scope of the performances in examination in the module descriptions the examination board decides in consultation with the examiners how performances in examination specifically have to be rendered. In the third week after beginning of the term the latest it will be announced in all courses by the teachers how the examination performances have to be rendered. This counts especially for the proof of the qualified participation and study performances. The examination performances relate to contents and competences of each related courses.

(3) All examinations are taken along the studies. The examinations usually take place two times within an academic year.

#### **§15. Forms of performance in examinations in modules, study performances and qualified participation**

(1) Examination performances can be rendered in form of written examinations, oral exams, written term papers or in other forms. The detailed description of each of the examination performances can be found in appendix B and the module descriptions. The assessment of the students can be found in the Campus Management System of the university after six weeks the latest after the achieved performance, except for oral exams.

(2) As examination performances are defined:

##### *1. Written examinations:*

In written examinations the candidate has to demonstrate that she or he is capable of recognise the problem of the subject with the help of the tools allowed by the examiner and solve it with the common methods within the given time frame. A list of the allowed aid has to be announced together with the date of the examination.

Every written examination is graded by one examiner. In case of the last resit the assessment is done by two examiners.

The duration of a sit-down examination depends on the sum of the credit points in a module. It takes 90 to 120 minutes at 5 credit points and 120 to 180 minutes at more than 5 credit points.

##### *2. Oral examinations:*

In the oral exam the candidate has to demonstrate that she or he recognises the connections within the examined area, is able to put concrete question into context and find solutions within the time given.

Oral examinations are performed in front of two examiners or one examiner in presence of one competent assessor as group examinations or as single examinations. In every case one has to be able to differentiate and grade the contribution counted as an examination performance of every candidate separately. Before setting a grade the examiner consult the assessor in absence of the candidate. In case of the last resit opportunity two examiners do the grading.

The duration of an oral exam per each candidate goes by the sum of the credit points of the underlying courses. It takes 20 to 30 minutes at up to 5 credit points and 30 to 45 minutes at more than 5 credit points. For group examinations the total duration of the examination extends accordingly. The general content and results of the examination have to be recorded in a protocol. The result of the examination has to be announced to the candidate subsequent to the oral exam by the examiner.

Students who want to take the same examination at a later examination date will be permitted according to the spatial conditions as listeners, as long as no candidate disagrees. Admission doesn't spread over to the consultation and announcement of the examination result.

3. A *presentation* is a performance of 30 minutes on a basis of a written composition. Thereby students have to prove that they are able to elaborate a topic scientifically and can present results.

4. In the course of a *written term paper* with a scope of ten DIN-A4 pages a task is dealt with and solved properly within a thematic area of a course with the help of relevant literature if necessary. The achievement can also be made as a group achievement, as long as an individual assessment and evaluation of every group member is possible.

5. In a *colloquium* students have to prove that they can recognise professional relations and are able to put concrete questions into a context in a conversation of 20 to 30 minutes with the examiner and other participants of the colloquium.

6. In a *project work* students work on a topic given by the teacher by themselves or in a group. Project works usually include a draft and structure of hardware and software prototypes, as well as an ensuing experimental evaluation. Other parts of a project work are usually the technical documentation and the presentation of the work and its results.

(3) A *qualified participation* is given when the achieved performances indicate that the subjects lying within a problem definition have been dealt with more than just superficially. The proof of a qualified participation can be requested in a module, if this is necessary for protection of the skill acquisition in the module besides the module examination. The proof of a qualified participation in a module can be a requirement for allocations of credit points or a requirement for participations in performances in examinations. The proof of the qualified participation is made especially by

- One or more short written examinations
- An expert discussion
- The preparation of a protocol
- Confirmation of attendance or
- A presentation

(4) As a course work exercises can be requested which usually are put as homework and / or presence tasks on a weekly basis.

## **§16. Evaluation of performance in examination and developing grades**

(1) Grades for individual performances in examination are determined by the respective examiners. Performances in examination have to be graded with the following grades:

1 = very good: an excellent performance

2 = good: a performance, which lies significantly above the average requirements

3 = satisfactory: a performance, which corresponds to average requirements

4 = satisfactory: a performance, which meets the requirements despite its deficiencies

5 = imperfect: a performance, which doesn't meet the requirements due to its significant deficiencies

(2) For a differentiated assessment intermediate values can be built by lowering or rising the individual grades about 0,3. Thereby the intermediate values 0,7; 4,3; 4,7 and 5,3 are excluded.

(3) If a performance in examination is graded by several examiners, the grade is built by the arithmetic mean of the individual grades. Apart from that paragraph 4, section 2 and 3 apply accordingly.

(4) If an overall module grade is composed by several grades, the arithmetic mean has to be built weighted by the workload of the related courses. The result has to be rounded after the first decimal place after the comma. The grade is:

At an average until including 1,5 = very good,

At an average above 1,5 until including 2,5 = good,

At an average above 2,5 until including 3,5 = satisfactory,

At an average above 3,5 until including 4,0 = satisfactory,

At an average above 4,0 until 5,0 = imperfect

(5) Qualified participations have to be proven.

(6) Course works are graded as "passed" or "not passed".

## **§17. Thesis module**

(1) The thesis module consists of a work plan (qualified participation according to § 15, paragraph 3 and workload 150 hours) and the master's thesis including an interim presentation and a final presentation (workload 750 hours).

(2) The master's thesis is an examination thesis which concludes the scientific training and has to show that the candidate has the ability to deal with a problem of Computer Engineering according to scientific methods within a given time period. The problem definition for the thesis module has to be designed in a way in which it equals a workload of 900 hours (30 credit points) in total. The master's thesis usually has a scope of not more than 120 DIN–A4 pages. The interim presentation usually takes 30 to 40 minutes, the final

presentation between 45 and 60 minutes. The time limitation for completing the master's thesis is 6 months.

(3) The master's thesis is provided and overseen by a person with inspector qualification appointed by the examination board according to § 9, paragraph 1. The master's thesis is done within a chosen emphasis area according to § 10, paragraph 4. The candidate receives the possibility to make suggestions for the topic of the master's thesis. The suggestions don't explain a legal claim.

(4) On application the chairperson of the examination board ensures that a candidate receives a topic for the master's thesis on time. The topic is given immediately after the acceptance of the work plan by the chairperson of the examination board. The time period needed for giving the topic has to be recorded by the central examination office.

(5) The master's thesis can also be admitted in form of a group work when the contribution of every candidate, which will be judged as a performance in examination, can be clearly differentiated on the basis of indication about paragraphs, number of pages or other objective criteria which allow a clear delimitation and assessed and fits the requirements according to paragraph 2.

(6) The topic and task of the master's thesis is communicated to the candidate in written form. The topic can only be given back once and within the first two weeks after the announcement. The time limitation begins again with the assignment of the new topic. On a case-by-case basis the examination board can extend the time limitation for the master's thesis on an explained application of the candidate on six more weeks at the most when the reasons for it are related to the topic of the master's thesis and the responsible mentor supports it.

(7) In case of illness during the time limitation the deadline for submission of the master's thesis can be extended on four more weeks at the most on application of the candidate. In addition a medical certificate has to be handed in immediately. A medical certificate is enough for passing the inability to take an examination. When there are sufficient actual indications or a different appropriate proof, which make accept an inability to take an examination as possible, a medical certificate of a medical officer of the University of Paderborn can be requested at the University of Paderborn's expense. If the examination board accepts the request, it will be told the candidate in written form. The extension equals the duration of the illness; it doesn't entail an extension of the normal course length. When the duration of the illness exceeds four weeks, then the candidate may choose between ending the deadline extended for four weeks or apply for a new topic. If the examination board denies the application, it will be told the candidate in written form as well.

(8) The master's thesis isn't allowed to have been made for a different examination in the same or in another degree program, not even in part.

(9) When submitting the master's thesis the candidate has to assure in written form that she or he has written the paper – in case of a group work the relevant part of the paper – independently and didn't use any other sources than those indicated as aid and has to indicate the quotes as well.

(10) Not later than four weeks after the announcement of the topic the candidate presents the approach and the schedule for the master's thesis in an interim presentation. Not later than four weeks after submitting the master's thesis the final presentation about the topic of the master's thesis and its results is held and

### **§18. Acceptance of the Master's thesis and assessment of the module Dissertation**

(1) The assessment of the thesis module is made according to § 16. The grade of the master's thesis is at the same time the grade of the thesis module. The requirement for completion of the module and for the award of credit points is the proof of the qualified participation in form of a work plan. The first examiner approves the qualified participation according to § 16, paragraph 5.

(2) The master's thesis has to be submitted on time at the examination board in two copies (typewritten, binded and paginated), additionally once in electronic form by a physical medium. The date of submission has to be documented by the examination board. In case of handing in the thesis by post the date of delivery at the post office (postmark) is decisively. When the master's thesis is not handed in according to the deadline, it is considered as graded with "imperfect" (5,0).

(3) The master's thesis including the interim and final presentation has to be examined and graded by two examiners according to § 12. Besides the first examiner according to §17 paragraph 3 the examination board chooses the second examiner. The grade for the thesis is built by the arithmetic mean of the individual valuations, if the difference is smaller than 2,0 and each of the grades of the individual valuations is at least a "satisfactory". §16 paragraph 4 sentences 3 and 4 apply accordingly. When the difference is 2,0 or more or one assessment is "imperfect" but the other one at least "satisfactory", the examination board chooses a third examiner for the assessment of the master's thesis (without the final presentation). In this case the grade is built by arithmetic mean of the two better marks. The thesis can only be assessed as "satisfactory" or better when at least two grades are "satisfactory" or better. §16 paragraph 4 sentences 3 and 4 apply accordingly.

(4) The master's thesis is passed when the grade is at least a "satisfactory" (4,0). The assessment of the master's thesis has to be told the students six weeks after submission of the thesis at the latest.

### **§19. Assessment of the Master's thesis and building the final grade**

(1) The master's examination is passed, when all of the module examinations according to § 10 including the thesis module are assessed at least with the grade "satisfactory".

(2) The overall grade is built by weighting all module grades by credit points, differing from that the project work module is weighted with the factor  $\frac{1}{2}$  and the thesis module is weighted twice and out of it the arithmetic mean is built. Additional performances according to § 23 are not taken into the overall grade.

During the calculation of the result only the first decimal place after the comma is taken into account, all the other digits are deleted without rounding. The grade is:

At an average until including 1,5 = very good,

At an average above 1,5 until including 2,5 = good,

At an average above 2,5 until including 3,5 = satisfactory,

At an average above 3,5 until including 4,0 = satisfactory,

At an average above 4,0 until 5,0 = imperfect

(3) The overall judgement "passed with distinction" is given when the grade of the thesis module is 1,0, the average of the module grades weighted by the credit points is at least 1,3 and none of the module grades is worse than "good".

## **§20. Repetition of examinations, compensation**

(1) A passed examination can't be repeated. Paragraph 13 remains unaffected.

(2) A failed examination can be repeated twice. In case of a sit-down examination the second retake will be replaced by an oral substitute test over the entire grading scale (§ 16, paragraph 1 – 2). § 15, paragraph 2, No. 2 applies accordingly.

(3) A passed examination in the compulsory elective area, which is registered as an additional achievement according to § 23, can be exchanged for a passed or a not yet or finally failed examination according to section 2 (compensation). Compensation is possible in the chosen consolidation area for two modules within the consolidation area and for two random courses within the remaining compulsory elective area.

(4) A module examination is passed when it has been assessed with at least a "satisfactory". A module examination is finally failed when the final module examination or a partial module examination can't be repeated or compensate.

(5) The thesis module can be repeated once in case of an "imperfect" assessment of the master's thesis. A second repetition is excluded. The return of the topic of the master's thesis within the time period defined in § 17, paragraph 6 sentence 2 is only permitted when the candidate didn't make usage of this possibility during the preparation of her or his first master's thesis.

(6) For the repetition of the thesis module the candidate may suggest a different examiner. There is no legal claim.

## **§21. Withdrawal, cheating, infringement of regulation and protective instructions**

(1) An opt-out from examinations can be made by not later than one week before the respective examination date at the Campus Management System of the University of Paderborn without giving reasons.

(2) A performance in examination is assessed with "imperfect" (5,0) when the candidate doesn't appear on an examination date without any good reasons or withdraws from an examination without good reasons or withdraws from an examination after the end of the opt-out deadline according to paragraph 1. The same counts for a written performance in examination which is taken within the given process time.

(3) The reasons claimed for failure or withdrawal must be indicated in written form and made credible immediately for the examination board, but not later than five working days after the respective examination date. In case of an illness of the candidate a medical certificate about the inability of taking an examination, dated on the day before the examination at the latest suffices. If there are sufficient actual indications, which let the inability to take an examination be accepted as probable or let a proof seem appropriate, a medical certificate of a medical officer or a medical officer of the University of Paderborn can be requested on the costs of the University of Paderborn. The illness of the child documented by the medical certificate in terms of § 25, paragraph 5 of the Federal Law on Support for Education and Training counts



as inability of taking an examination of the candidate when care couldn't be guaranteed in a different way, especially in case of a mainly sole care. If the examination board accepts the reasons, it will be told the candidate in written form and a new examination date will be set. In this case already existing examination results have to be taken into account. If the examination board doesn't accept the reasons, it will be told the candidate in written form.

(4) If a candidate cheats or she or he tries to cheat, the respective performance in examination has to be assessed with "imperfect" (5,0). If the candidate brings a not allowed aid with her or him, the respective performance in examination can be assessed with "imperfect" (5,0). The incidents will be documented by the respective invigilators. The assessment according to section 1 or the decision according to section 2 will be made by the respective examiner.

(5) A candidate who disturbs the proper procedure of the examination can be excluded from continuing the examination, usually after a warning by the respective examiner or invigilator; in this case the respective performance in examination has to be assessed with "imperfect" (5,0). The reasons for exclusion have to be documented.

(6) In grave cases the examination board can exclude candidates from further performances in examination. Acts of deception according to HG § 63, paragraph 5 can furthermore be punished with a fine of up to 50 000 € and lead to deregistration.

(7) The candidate can request within 14 days that the decisions according to paragraph 4 or paragraph 5 are checked by the examination board. Onerous decisions of the examination board have to be told the candidate immediately in written, explaining and provided with a recourse instruction form. Before making a decision the candidate has to be given the chance for a hearing in accordance with the law.

(8) Furthermore the examination board regulates the disability compensation for students with a disability or chronic disease. If a student is unable to achieve performances entirely or partly according to the provided mobilities due to his disability or chronic disease disability compensation has to be granted. As a disability compensation granting of organisational measures and aid, extension of time limitation or permission of another equivalent form of supplying a performance come into question. The disability or chronic disease has to be made credible. Additionally a medical certificate or a psychological expertise can be requested. The application has to name and explain the requested modification. On application of the student or the examination board and in agreement with the student the representative for students with disability or chronic disease can submit recommendations for the design of the disability compensation.

(9) Special situations of students with family responsibilities during the course of studies and when rendering performances will be taken account of. This happens inter alia in following forms:

1. On application of a candidate safeguards according to §§ 3, 4, 6 and 8 of the Maternity Protection Act have to be taken into account accordingly. Necessary proofs have to be added to the application. The examination board can determine other forms of supplying a performance in consideration of an individual case. Maternity protection periods interrupt every time period according to these examination regulations or the special regulations; the duration of the maternity protection will not be counted into the time period.

2. Also the time periods of parental leave have to be taken into account on application according to the respective valid legislation on parental allowance and parental leave. The candidate has to tell the examination board in written form with all relevant information not later than four weeks before the point in time from which she or he wants to start the parental leave for which time period or time periods she or he wants to make use of the parental

leave. The examination board examines whether legal preconditions exist which would create an entitlement on parental leave according to the legislation on parental allowance and parental leave for an employee and sets dates and deadlines under consideration of the individual case. The deadline for the bachelor's thesis can be only extended on not longer than twice of the planned process time. Otherwise the set thesis counts as not assigned and the candidate receives a new topic after the expiration of the parental leave.

3. On application the examination board takes downtime due to care and education of children in terms of § 25, paragraph 5 of the Federal Law on Support for Education and Training and downtime due to care of the spouse, registered life partner, partner of a cohabitation or a direct relative or a relative related in marriage in first degree into account and sets under consideration of the individual case deadlines and dates. Otherwise sentences 4 and 5 from number 2 count accordingly.

## **§22. Completion of studies, final failure**

(1) Studies are completed successfully when the master's examination is passed. The master's examination is passed when all modules of the degree program including the final module are successfully completed.

(2) The master's examination is finally failed when a module is finally failed and compensation according to § 20, paragraph 3 is not possible.

(3) The notification about a finally failed master's examination will be given the candidate in written form by the examination board. The notification has to be supplied with a recourse instruction.

(4) If a candidate has finally failed the master's examination, she or he will receive a testimonial on application, which contains the achieved performances and achieved credit points, if necessary, and which indicates that the master's examination has been finally failed.

(5) Students who leave the university without graduating and for other reasons have to receive a testimonial after deregistration which contains the achieved performances and, if necessary, the achieved credit points on application.

## **§23. Additional modules**

(1) Beyond the achievements required in § 10 students can take examinations for modules with a scope of up to 24 credit points. Failed examinations also fall under this ceiling. Regulations for modules with a limited number of participants according to § 59 HG remain unaffected. Grades achieved with additional modules are listed in the "Transcript of Records", unless the student requests those not to be listed until submission of the thesis. These won't be taken into account while building the final grade within the master's examination.

(2) Under consideration of the upper limit indicated in section 1 a transfer for the purpose of compensation according to § 20, paragraph 3 is possible. Failed examinations fall under the upper limit as well.

(3) Additional performances have to be indicated as such at the registration.

## **§24. Certificate, Transcript of Records and Diploma Supplement**

(1) If a candidate has completed the studies successfully, she or he receives a certificate of the result. This certificate includes the name of the degree program, normal program length and the final grade. The certificate shows the date of the last performance in examination. In addition the date of the certified copy is shown. The certificate is signed by the chairperson of the examination board.

(2) Also the candidate receives a Transcript of Records in which all rendered performances in examination and the duration of professional studies are listed. The Transcript of Records contains information about credit points and achieved grades of the completed modules and the master's thesis. Moreover it contains the topic of the master's thesis and the achieved overall grade of the master's examination.

(3) Together with the examination certificate the graduate receives a Diploma Supplement.

(4) The Diploma Supplement is an addition to the certificate in English and German language with uniform information about German university degrees, which explain the German education system and classify of the existing degree. The Diploma Supplement informs about the completed degree program and the academic and professional qualifications gained with the qualification. The Diploma Supplement contains the essential course contents underlying the qualification, route of studies, competences gained with the qualification as well as the awarding university.

## **§25. Masters degree certificate**

(1) Along with the certificate for the passed master's degree the candidate receives a Masters degree certificate with the date of the certificate. There the awarding of the master's degree is certified according to § 2.

(2) The Masters degree certificate is signed by the department head of the Faculty for Electrical Engineering, Computer Science and Mathematics and furnished with the seal of the University of Paderborn.

(3) A translation in English language is added to the Masters degree certificate.

## **§26. Inspection of examination files**

(1) The candidate can be given the chance to have an insight into her or his written performances in examination and the related assessments of the examiners after the announcement of the grades. The chairperson of the examination board decides about place and time of the inspection; her or she can delegate these tasks to the examiners. Place and time of the inspection have to be announced during the examination at the latest during the announcement of the grade.

(2) If paragraph 1 is not applied, the candidate will be allowed on application to have an insight into her or his written performances in examination, the related assessments of the examiners and the examiners' report at the latest a month after the announcement of the results of the respective examinations. Within one year after handing over the certificate the candidate is allowed on application to have an insight into the bachelor's thesis, the related expert opinions of the examiners and the examiners' report. The chairperson of the

examination board decided about place and time of the inspection; he or she can delegate this information to the examiners.

#### **IV. Final Regulations**

##### **§27. Invalidity of master's examination**

(1) If a candidate has deceived during an examination and this fact comes out only after the handing over of the certificate, the examination board can post hoc correct the grades for those performances in examination, during which the candidate has deceived, accordingly and announce the examination as entirely or partially failed.

(2) When the requirements for admission to an examination were not fulfilled, without the candidate wanted to deceive about this, and this fact has come out after handing out the certificate, this deficiency will be undone by letting the examination be passed.

(3) Before the decision the affected person has to be given the opportunity for giving a statement.

(4) The false certificate has to be taken back and a new one has to be given if necessary. A decision according paragraph 1 and paragraph 2 is excluded after a time period of five years after issuing the examination certificate.

(5) If the master's examination in total has been declared as failed, the master's degree has to be denied and the Masters degree certificate has to be collected. The withdrawal of the master's degree is only allowed within five years since the date of the awarding of the degree.

##### **§28. Coming into effect and publication**

The master's degree is denied when it transpires subsequently that it has been acquired by deception or when essential requirements for the awarding have been erroneously considered as given.

##### **§29. Transition regulations**

(1) These examination regulations apply for all students who are registered for the master's degree course Computer Engineering of the faculty for Electrical Engineering, Computer Science and Mathematics at the University of Paderborn for the first time starting from the winter term 2017/18.

(2) Students who have been registered at the University of Paderborn for the master's degree course Electrical Engineering, Computer Science and Mathematics before the winter term 2017/18 can take the master's examination including the resits for the last time in the summer term 2020 according to the examination regulations in the form of May 31<sup>st</sup> 2013 (Am.Uni.PB 43/13), last changed by the statutes from December 11<sup>th</sup> 2015 (Am.Uni.PB 107/15). Starting from the winter term 2020/2021 the master's examination including the resits is taken according to these examination regulations.

(3) On application students can switch into these examination regulations. The switch is irrevocable.

### §30. Date of effectiveness and publication

(1) These examination regulations come into force on October 01<sup>st</sup> 2017. Concurrently the examination regulations of May 31<sup>st</sup> 2013 (Am.Uni.PB 43/13), last changed by the statutes from December 11<sup>th</sup> 2015 (Am.Uni.PB 107/15) cease to be in force. § 29 remains unaffected.

(2) These examination regulations will be published in the official communications of the University of Paderborn (AM Uni. Pb.).

Written out because of the faculty executive committee for the faculty of Electrical Engineering, Computer Science and Mathematics of April 24<sup>th</sup> 2017 and the legality audit by the President's cabinet of the University of Paderborn of May 24<sup>th</sup> 2017.

Paderborn, June 16<sup>th</sup> 2017

For the President  
The Vice President for Economy and Personnel  
Management of the University of Paderborn

Simone Probst

### Appendix A: Timetable Master Computer Engineering

The following illustration shows an exemplary course timetable of the master's degree course Computer Engineering with its modules and credit points (CP) per module. For every module the courses are listed, in each case with information about the semester periods per week (attendance time) and the workload. Per semester the weekly attendance time in total and the achievable credit points are indicated.

1 <sup>st</sup> semester 20 SWS / 30 CP	2 <sup>nd</sup> semester – SWS / 30 CP	3 <sup>rd</sup> semester – SWS / 30 CP	4 <sup>th</sup> semester – SWS / 30 CP
Consolidation area 24 CP (4 modules from 1 out of 6 consolidation areas)			Thesis (30 CP)
Module 1 e.g. 2+2 SWS / 180h	Module 2 e.g. 2+2 SWS / 180h	Module 4 e.g. 2+2 SWS / 180h	Work Plan – / 150h
	Module 3 e.g. 2+2 SWS / 180h		Master's Thesis – / 750h
Compulsory module ET I 6 CP	Other compulsory elective modules 18 CP (3 random selectable options)		
Statistical Signal Processing* 2+2 SWS / 180h	Module 1 e.g. 2+2 SWS / 180h	Module 2 e.g. 2+2 SWS / 180h	
Compulsory module ET II		Module 3 e.g. 2+2 SWS / 180h	

6 CP		
Circuit and System Design e.g. 2+2 SWS / 180h	Project group 18 CP	
Compulsory module Computer Science I 6 CP	Project group Computer Engineering - / 540h	
Advances Computer Architecture e.g. 2+2 SWS / 180h	Scientific Working 6 CP	
Compulsory module Computer Science II 6 CP	Seminar - / 120h	
Networked Embedded Systems e.g. 2+2 SWS / 180h	Languages, Writing and Presentation Technology - / 60h	

\* can be replaced by processing of statistic signals

#### **Consolidation areas:**

- Embedded Systems
- Nano / Microelectronics
- Computer Systems
- Communication and Networks
- Signal, Image and Speech Processing
- Control and Automation

#### **Other compulsory elective modules:**

Modules can be chosen from all 6 consolidation areas.

#### **Thesis:**

Topic of the master's thesis from the consolidation area.

#### **Appendix B: Module in the master's degree course Computer Engineering**

As a result of the further development of the research and teaching content of the institutes for Computer Science and for Electrical Engineering and Information Engineering modules in the compulsory elective area of the following list can be omitted in small number or be replaced by modules, which professionally belong to the same area, in small number or complemented. Changes are announced in the module handbook. Regulations of the

performances, of the scope as well as the individual course requirements remain unaffected from it.

Module Course (LV)	LP Module SWS LV	Number and form of examinations	Notes
<b>Compulsory module Computer Science I</b>	<b>6</b>	1 oral examination or written examination as final module examination	Compulsory module Requirements for participation in module examination: study performance
Network Embedded Systems	2+2		
<b>Compulsory module Computer Science II</b>	<b>6</b>	1 oral examination or written examination as final module examination	Compulsory module
Advanced Computer Architecture	2+2		
<b>Compulsory module Electrical Engineering I</b>	<b>6</b>	1 oral examination or written examination as final module examination	Compulsory module; Can be replaced by: Processing of statistical signals (2+2)
Statistical Signal–Processing	2+2		
<b>Compulsory module Electrical Engineering II</b>	<b>6</b>	1 oral examination or written examination as final module examination	Compulsory module;

Module Course (LV)			Notes
Circuit and System Design	2+2	Examination or written examination as final module examination	
<b>Scientific Working</b>	<b>6</b>	1 presentation in the seminar	Compulsory module;
Seminar	4		The qualified participation according to § 8 (5) in Languages, Writing and Presentation Technology
Languages, Writing and Presentation Technology	2		
<b>Compulsory elective modules from the consolidation area</b>	<b>24</b>	Per module 1 oral examination or written examination as final module examination	Requirements for the participation in the module examination in modules from computer science: Course performance
Selection from the module catalogue one of six consolidation areas			
<b>Further compulsory elective modules</b>	<b>18</b>	Per module 1 oral examination or sit–down examination as final module examination	Requirements for the participation in the module examination in modules from computer science: Course performance
Arbitrary selection out of all module catalogues of the six consolidation areas			

<b>Project group</b>	<b>18</b>	<b>Project work</b>	
<b>Thesis</b>	<b>30</b>	See § 18, § 19	Condition for completion of the module and the award of credit points is the proof of the qualified participation according to § 8 (5) in form of a work plan. Admission to the thesis module after a successful completion of modules with a scope of 45 CP only; the master's thesis has to be out of the consolidation area.
Work plan			
Master's thesis			

### **Courses in the area "Languages, writing and presentation technology"**

A subject can be selected from the range of courses at the University of Paderborn in the subject areas Foreign Languages, Writing Scientific Texts and Presentation Technology. The range of courses is shown in the lecture timetable of the University of Paderborn. The aim of these optional subjects is to ensure enhancement and specialisation of interdisciplinary qualifications.

### **List of consolidation area with associated modules**

The following consolidation areas and modules within the consolidation are listed in alphabetical order.

#### Consolidation area "Communication and Networks"

- Advanced Distributed Algorithms and Data Structures
- Empiric Performance Evaluation
- Foundations of Cryptography
- Future Internet
- Mobile Communication
- Network Simulation
- Optical Communication A
- Optical Communication B
- Optical Communication C
- Optimal and adaptive filter
- Routing and Data Management in Networks
- Topics in Signal Processing
- Vehicular Networking
- Wireless Communications



#### Consolidation area "Computer Systems"

- Adaptive Hardware and Systems
- Algorithms and Tools for Test and Diagnosis of Systems on a Chip
- Algorithms for Synthesis and Optimization of Intergrated Circuits
- Architecture of parallel Computer Systems
- Compiler Construction
- Databases and Information Systems
- Empiric Performance Evaluation
- Hardware / Software Codesign
- High-Performance Computing
- Intelligence in Embedded Systems
- Reconfigurable Computing
- VLSI Testing

#### Consolidation "Control and Automation"

- Advanced Control
- Advanced System Theory
- Advanced Topics in Robotics
- Biomedical Measurement Engineering
- Dynamic Programming and Stochastic Control
- Regulated Three-phase Drive
- Optical Measurement Engineering
- Robotics
- Ultrasound-Measurement Engineering
- Environmental Metrology

#### Consolidation area "Embedded Systems"

- Adaptive Hardware and Systems
- Advanced VLSI Design
- Algorithms and Tools for Test and Diagnosis of Systems on Chip
- Algorithms for Synthesis and Optimization of Intergrated Circuits
- Architecture of parallel Computer Systems
- Compiler Construction
- Hardware / Software Codesign
- Intelligence in Embedded Systems
- Model-Driven Software Development
- Network Simulation
- Reconfigurable Computing
- Quickly integrated circuits for the digital communication technology
- Software Quality Assurance
- VLSI Testing
- Vehicular Networking

#### Consolidation area "Nano / Microelectronics"

- Advanced VLSI Design
- Algorithms and Tools for Test and Diagnosis of Systems on Chip
- Algorithms for Synthesis and Optimization of Intergrated Circuits
- Introduction into High Frequency Technology
- Semi-conductor Process Technology

- High Frequency Engineering
- Quickly integrated circuits for the digital communication technology
- Technology of highly integrated circuits
- VLSI Testing

Consolidation area "Signal, Image and Speech Processing"

- Advances System Theory
- Digital Image Processing I
- Digital Image Processing II
- Digital Speech Processing
- Cognitive Sensor Systems
- Measurement stochastic
- Optimal and adaptive filters
- Statistical learning methods and pattern recognition
- Technical cognitive systems
- Topics in Pattern Recognition and Machine Learning
- Topics in Signal Processing
- Video technology
- Wireless Communication

#### **List of all compulsory elective modules in alphabetical order**

- Adaptive Hardware and Systems
- Advanced Control
- Advanced Distributed Algorithms and Data Structures
- Advanced System Theory
- Advanced Topics in Robotics
- Advanced VLSI Design
- Algorithms and Tools for Test and Diagnosis of Systems on Chip
- Algorithms for Synthesis and Optimization of integrated Circuits
- Architecture of parallel computer system
- Biomedical measurement technology
- Compiler Construction
- Databases and Information Systems
- Digital Image Processing I
- Digital Image Processing II
- Digital speech processing
- Dynamic Programming and Stochastic Control
- Introduction into high frequency technology I
- Empiric Performance Evaluation
- Foundations of Cryptography
- Future Internet
- Regulated Three-phase Drive
- Semi-conductor process technology
- Hardware / Software Codesign
- High Frequency Engineering
- Cognitive Sensor Systems
- Measurement Stochastic
- Mobile Communication
- Model-Driven Software Development
- Network Simulation
- Optical Communication A
- Optical Communication B

- Optical Communication C
- Optimal and adaptive filter
- Optical Measurement Method
- Reconfigurable Computing
- Robotics
- Routing and Data Management in Networks
- Quickly integrated circuits for the digital communication technology
- Software Quality Assurance
- Statistical learning methods and pattern recognition
- Technical cognitive systems
- Technology of highly integrated circuits
- Topics in Pattern Recognition and Machine Learning
- Topics in Signal Processing
- Ultrasound–Measurement Technology
- Environmental Metrology
- Vehicular Networking
- Video technology
- VLSI Testing
- Wireless Communication

### **Appendix C: Obligation courses**

In case of admission with conditions according to § 4, paragraph 1, section 2b, obligation courses have to be completed, if necessary, before the master's thesis can be registered. The following obligation courses are possible:

obligation course	Scope
Basics Human–Machine–Interaction	2 SWS
Mathematics 1 and 2	4 SWS
Models and Algorithms 1 and 2	4 SWS
Soft Skills, Management	2 SWS
Software Engineering 1 and 2	4 SWS
Systems 1 and 2	4 SWS