

Of October 30th 2017

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

Paderborn University has issued the following examination regulations on the basis of Section 2 (4) and Section 64 (1) of the North Rhine–Westphalia Higher Education Act (*Hochschulgesetz*, "HG") of September 16th 2014 (GV.NRW. p. 547), last amended by Article 4 of the April 07th 2017 Act (GV.NRW. p. 414). Paderborn University has issued the following regulations:

This is a non-official version

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I. General

§1 Purpose of the exams, aim of program and language arrangement

- (1) The master's program is designed to give candidates advanced engineering foundations and specific knowledge, skills and methods in the field of Electrical Systems Engineering. In addition to the general study aims according to Section 58 of the HG, the program enables students to apply and further develop the scientific methods of Electrical Systems Engineering in their work and to act responsibly with regard to the effects of technological change.
- (2) The purpose of the Master's examination is to determine whether the candidates have broadened the knowledge necessary for professional practice, which they gained in their preceding first degree and developed in selected areas, so that they are able to apply appropriate scientific methods from the field of Electrical Systems Engineering in order to solve problems and further develop them in their area of specialization.
- (3) The Master's program is taught in English. All examinations are in English.

§2 Academic degree

As soon as the Master's program is successfully completed, the faculty for Electrical Engineering, Computer Science and Mathematics confers the academic degree of Master of Science, abbreviated: M.Sc.

§3 Beginning of studies

The beginning of studies is the winter term. (October)

§4 Licensing requirements

- (1) Admission to the Master's program in Electrical Systems Engineering is open to anyone who jointly meets the following prerequisites:
 1. Have a university qualification certificate (general or relevant subject-linked university entrance qualification), or a certificate recognized as equivalent under a legal provision or by the competent state body, or meeting the qualification requirements for professional training,
 2. Has a university degree and fulfils the following requirements:
 - a) Hold a first university degree qualifying for a profession obtained at a university within the jurisdiction of the German Basic Law, with a standard period of study of at least 6 semesters in electrical engineering or a comparable course of study, demonstrating the educational requirements for the Master's program pursuant to paragraph 2, or hold an equivalent degree from a foreign university. For determining the equivalence of foreign degrees the agreements of equivalence as approved by the Conference of the Ministers of Education and Cultural Affairs and the German Rectors' Conference, or corresponding legal provisions, have to be considered. If there are doubts about the equivalence of achievements the Central Office for Foreign Education may be consulted.

For foreign diplomas, equivalency agreements approved by the Standing Conference of the State Ministers of Education and the Arts in the Federal Republic of Germany and the Rectors' Conference or relevant legal regulations, have to be taken into account. In case agreements of the Federal Republic of Germany with other states about the equivalence in the higher education sector (equivalency agreements) favour students from foreign states differing from section 2, the regulations of the equivalency treaty are preferred. Otherwise, in case of doubts about the absence or presence of significant differences, the Central Office for Foreign Education has to be consulted. The examination board makes the determination about the requirements according to section 2.

b) The qualification has to contain parts of studies in the following areas and of a minimum scope of:

Higher Mathematics	at least 24 CP (Credit Points)
Electromagnetic Field Theory	at least 5 CP
Signal Theory	at least 4 CP
Systems Theory	at least 4 CP

The examination board makes the decision about the requirements. If credit points are missing, the enrolment can be made under the condition of making up for the requirements by appropriate studies and passing the associated examinations before the registration for the Master's thesis. The examination board makes the decision about this, as well as about the type and scope of the studies and examinations on the basis of the previous qualifications. The studies which are missing or have insufficient credit points are only allowed to affect the areas of Signal, Systems and Field Theory. The studies and the examinations have to be completed within the first semester of the Master's program.

c) The qualification must be completed with a final grade of at least 2,5 (or at least an equivalent foreign final grade).

3. Has sufficient English language skills according to paragraph 2, and

4. All prospective foreign students who aren't equivalent to Germans residents through or due to treaties under international law, prove their ability to study by means of the GRE Revised General Test. In the part "Quantitative Reasoning" usually at least 157 points are necessary, and at least 4,0 points are needed in the part "Analytical writing". In case of a very good or good final grade of the qualification according to n°2, the proof of the GRE Revised General Test is not necessary. Prospective students with a German university entrance qualification are excluded from this proof of the ability to study.

(2) Sufficient skills in the English language has to be proven as follows:

- a) Bachelor's degree in an English speaking foreign country¹ or in an international degree program accredited as English speaking, or
- b) Test of English as Foreign Language (TOEFL) "Internet-based" (iBT) with a result of at least 87 points, or
- c) TOEFL "Paper-based" Test (PBT) with a result of at least 585 points, or
- d) IELTS-Test with a result of at least 6.0, or
- e) Cambridge English: First (FCE) or equivalent examination results

(3) Enrolment has to be declined, if

- a) The requirements named in paragraphs 1 – 2 are not fulfilled, or

¹ These are, in the course of these regulations, Australia, Great Britain, Ireland, New Zealand and the United States of America.

b) The candidate has failed an examination which is required according to the examination regulations in the desired degree at a university within the scope of the basic law, or

c) The candidate has failed an examination required according to the examination regulations in another degree at a university within the scope of the basic law, when not only the failed degree program shows a considerable content-related closeness to the Master's program Electrical Systems Engineering of Paderborn University, but also the failed examination shows a considerable content-related closeness to a compulsory module of the Master's program Electrical Systems Engineering of Paderborn University. The examination board makes the determination about such content-related closeness.

§5 Prescribed period of study and extent of studies

- (1) The normal program length for the Master's degree is, including the master's examination, four semesters. It is equivalent to a total workload of 3,600 hours.
- (2) The Master's program involves modules with a total scope of 120 credit points (CP). This includes compulsory modules with a workload of 30 CP, compulsory elective modules of 36 CP, a two semester project module of 18 CP, the extracurricular studies module of 6 CP, and the Master's thesis module of 30 CP.
- (3) Credit points are given according to the relevant European Credit Transfer System (ECTS). One credit point equals a workload of 30 hours on average. One semester usually involves 30 CP and therefore a workload of 900 hours. One credit point equals one ECTS-point according to the European Credit Transfer System and equals a workload of 30 hours on average.
- (4) The Faculty for Electrical Engineering, Computer Science and Mathematics has developed an exemplary curriculum and a module guide on the basis of the examination regulations. These documents describe aims and contents of the individual modules in detail, as well as the allocated courses and recommended prior knowledge. The exemplary curriculum, the list of modules, and the module guide are attached to these examination regulations in the Appendices A, B and C. The module guide reflects the current state of the examination regulations at the time of the resolution. The module guide is updated on a regular basis and is published on the websites of the Institute of Electrical Engineering and Information Technology.
- (5) The study contents described in the module guide are chosen and limited so that the studies can be completed within the normal program length.
- (6) The extracurricular studies module has to be covered with courses outside the field of Electrical Systems Engineering. It is recommended to students without sufficient German language skills to choose two German language courses within the extracurricular studies.

§6 Modules

- (1) The Master's program Electrical Systems Engineering is offered in a modular form. Modules are thematically rounded, and provided with credit points and independent, examinable, qualification units. Modules have a scope of at least 3 – 18 CP (including the thesis module). They are usually scheduled in a way in which they can be completed within one to two semesters.
- (2) Besides the project work modules and the Master's thesis module, the Master's program consists of compulsory, compulsory elective, and elective modules, which are summarised in module groups.

- (3) For the compulsory elective modules, courses must be chosen out of catalogues, which are part of the module description.

§7 Accreditation of achievements

(1) Achievements which have been made in other degree programs or in degree programs at other state or state-approved higher education institutions, at other state or state-approved universities of cooperative education, or in degree programs at foreign state or state-approved higher education institutions, will be accepted on application, as long as there is no significant difference in gained competencies regarding the achievements which are being replaced. No schematic comparison has to be made, but an overall view regarding the purpose of accreditation for the continuation of studies and taking of examinations should be formed. For the accreditation of achievements in state-approved distance learning programs or in distance learning program units developed by North-Rhine Westphalia with other states and the federal government, section 1 and 2 apply accordingly.

(2) For the accreditation of achievements at foreign higher education institutions, the equivalence agreements approved by the Conference of the Ministers of Cultural Affairs and the Conference of University Rectors, as well as agreements within the university partnerships, have to be taken into account. As far as agreements of the Federal Republic of Germany with other states about the equivalency in the sector of the higher education institutions (equivalency agreements) favour students from foreign states differing from paragraph 1, the regulations of the equivalency agreements come first. In case of doubts about the presence or absence of significant differences, the Central Office for Foreign Education can be contacted.

(3) The Examination Board has to grade students into a semester on the basis of the accreditation according to paragraph 1.

(4) Knowledge and skills of prospective students, who are allowed to start with their studies due to an entrance examination according to § 49, paragraph 12 HG, will be accepted for achievement. The determination about the entrance examination in the certificate is obligatory.

(5) On application and on the basis of submitted documents, other skills and qualifications can be approved by the Examination Board, as long as the skills and qualifications are equivalent in content and level to the achievements which are to be replaced.

(6) The Examination Board is responsible for such recognition according to paragraphs 1 and 5. Before the determination about the presence or absence of significant differences or about the equivalency, the responsible expert representatives have to be consulted. If the recognition is refused, it has to be explained.

(7) The applicant has to submit information (especially knowledge and skills gained through achievements and examination results) necessary for the recognition, in a form determined by the examination board. The examination board has to decide on the application according to paragraph 1 no later than ten weeks after complete submission of all relevant information.

(8) The recognition will be marked in the certificate. If the achievements are approved, grades have to be taken on after a conversion, as long as the evaluation systems are comparable in the respective grade calculation. If there is no grade or if the evaluation systems are not comparable, the annotation "passed" is taken.

(9) An achievement can only be accredited once. This also counts for the recognition of other skills and qualifications.

§8 Examination board

(1) The executive committee of the Faculty for Electrical Engineering, Computer Science and Mathematics forms an examination board for the Master's program Electrical Systems Engineering. It is especially responsible for:

- The organisation of examinations and supervision of its implementation,
- The compliance of the examination regulations and procedures, and compliance of the accomplishment of examinations,
- Decisions about discrepancies made against examination regulations,
- The writing of an annual report to the faculty executive committee about the development of the examinations and program lengths,
- Other tasks clearly assigned to the examination board by these regulations.

(2) Furthermore, the examination board gives suggestions for the reform of the examination regulations and discloses the distribution of grades. The chairperson of the examination board is assigned the concrete tasks by these regulations. Furthermore, the examination board can transfer the completion of matters which are not of fundamental importance to the chairperson; this doesn't count for decisions about discrepancies and reports to the faculty representative committee. The chairperson reports to the examination board about decisions made by her or him alone. The examination board and the chairperson of the examination board are supported by the central examination office.

(3) The examination board consists of representatives of the Institute for Electrical Engineering and Information Technology. It is composed of the chairperson, the representative chairperson, and five more members. On suggestion of the chairperson, the representative chairperson, and two members from the group of professors, one member from the group of academic employees and two members from the group of students are elected into the faculty executive committee by their respective representatives. Representatives for the members of the examination board are elected, except for the chairperson and the representative chairperson. The term of office of the members from the group of professors and members from the group of academic employees is two years, and lasts from October 01st of the election year until September 30th of the next but one year, and is equivalent to the election period of the faculty executive committee. The term of office of the students is one year and lasts from October 01st of the election year until September 30th of the following year. Re-election is allowed. The regulations about gender equality according to § 11c HG have to be respected.

(4) The examination board is an authority in the field of administrative procedures and administrative procedural law.

(5) The examination board is quorate when, besides the chairperson or the representative chairperson, two more professors and at least one other voting member are present. The examination board decides with simple majority. In case of a tied vote the vote of the chairperson is pivotal. In case of educational-scientific decisions, especially in case of assessment and accreditation of performances, the student members of the examination board have only an advisory voice.

(6) The chairperson calls in the examination board. The convocation must be made when at least three members ask for it.

- (7) The sessions of the examination board are not public. The members of the examination board, their representatives, the examiners and assessors underlie the official secrecy. As long as they are not in public service, they are obliged to official secrecy by the chairperson of the examination board.
- (8) The members of the examination board have the right to witness the process of taking examinations.

§9 Examiners and assessors

- (1) The Examination Board appoints the examiners and assessors. The board may delegate this task to the Chair. All examiners are independent professors of courses in which, according to the curriculum and the module descriptions, performances in examination can be taken. Assessors can be called in as those who have taken at least a corresponding Master's examination or a comparable examination.
- (2) Examiners are independent in their examining role.
- (3) The candidate may propose examiners for the Master's thesis and, if there is a choice of several examiners, for the oral examinations. The candidate's proposals are to be taken into consideration if possible. This does not constitute a claim, however.
- (4) The Examination Board ensures to announce the names of the examiners to the candidate on time, usually four, and at least two weeks before the deadline of the respective examination. The announcement in the Management System of the University is sufficient.

II. Master's Examination

§10 Admission to the Master's exam

- (1) Only students enrolled in the Master's program in Electrical Systems Engineering at Paderborn University, or admitted as visiting students ("Zweithörer(in)") according to Section 52 (2) HG, may be admitted to the Master's examination.
- (2) According to available capacities, and on application to the Examination Board, students of the Bachelor's program Electrical Engineering, who have achieved at least 152 credit points in their Bachelor's program necessary for graduating and approximately fulfil the entry requirements for the Master's program Electrical Systems Engineering, can be admitted to the modules of the Master's program Electrical Systems Engineering, with the scope of maximum 24 credit points for one semester beyond paragraph 1. This regulation can be used only once, meaning that the process of pulling forward is not possible anymore when an admission to the pulled forward Master modules, beyond the degree program, has taken place. Repeating of a failed pulled forward Master's examination is possible only after enrolment in the Master's program Electrical Systems Engineering. Students have no claim for receiving admission to the Master's program Electrical Systems Engineering at a later date.
- (3) The Master's thesis can be started when:
 - a) In case of an enrolment under conditions according to § 3, paragraph 2 no. 2, passing of determined examinations has been proved, and

b) Modules with the scope of 60 credit points have been successfully completed. To this belong compulsory modules with the scope of 24 CP:

- *Advanced System Theory and Modeling & Simulation*
- *Fields & Waves and Circuit & System Design* (specialisation E&D)
- *Statistical Signal Processing and Statistical Learning & Pattern Recognition* (specialisation I&SP)

(4) Admission has to be declined, if the requirements mentioned in paragraphs 1 and 3 are not fulfilled.

§11 Aim, word limit and style of Master's examination

(1) Through the Master's examination the candidate shall prove that she or he has gained scientific knowledge and skills in the degree course Electrical Systems Engineering, and is able to work independently and scientifically.

(2) The Master's examination is taken in one of the specialisations "Signal & Information Processing" or "Electronics & Devices". At the beginning of the semester the candidate chooses a specialisation.

(3) When the candidate wants to change the specialisation, she or he has to make a written application to the Examination board. Already passed achievements in examination are credited as far as possible.

(4) The Master's examination consists of the following study-related module examinations:

a) Compulsory module *Advanced System Theory* from the module group *Introduction to Electrical Systems Engineering* with 6 credit points,

b) Compulsory module *Modeling & Simulation* from the module group *Introduction to Electrical Systems Engineering* with 6 credit points,

c) When choosing the specialisation *Signal & Information Processing*:

i. Compulsory module *Statistical Signal Processing* from the module group *Introduction to Electrical Systems Engineering* with 6 credit points,

ii. Compulsory module *Statistical Learning & Pattern Recognition* from the module group *Introduction to Electrical Systems Engineering* with 6 credit points,

or when choosing the specialisation *Electronics & Devices*:

iii. Compulsory module *Fields & Waves* from the module group *Introduction to Electronics & Devices* with 6 credit points,

iv. Compulsory module *Circuit & System Design* from the module group *Introduction to Electronics & Devices* with 6 credit points,

d) Compulsory module *Management of Technical Projects* from the module group *Management and Application* with 3 credit points,

e) Compulsory module *Topics in Systems Engineering* from the module group *Management and Application* with 3 credit points,

f) 2 compulsory elective modules from the module group *Fundamentals of Electrical Systems Engineering* with 6 credit points in each case,

g) While choosing the specialisation *Signal & Information Processing*:

2 compulsory elective modules from the module group *Signal & Information Processing*, or while choosing the specialisation *Electronics & Devices*:

2 compulsory elective modules from the module groups *Electronics & Devices* with 6 credit points in each case,

h) 2 compulsory elective modules from the module group *Electrical Systems Engineering* with 6 credit points in each case, as far as they are not credited for other modules,

i) 1 module *General Studies (Studium generale)* with 6 credit points: courses according to § 5, paragraph 6,

j) 1 compulsory elective module *Projects* with 18 credit points as a year-round project work, or 2 elective module *Projects* with 9 credit points each, in the form of two six-monthly project works,

k) *Master Thesis (Masterarbeit)* Module with 30 credit points.

- (5) The catalogues of the compulsory elective modules, including more detailed regulations of the form of the examinations, are added to these examination regulations in the appendix. On application, the examination board can permit another course on an individual basis. In this case, the board defines the obligatory performances in examinations and informs the applicant about it.

§12 Enrolment and registration deadline

- (1) For every module, a notification in the Campus Management System at Paderborn University is necessary. The registration can only take place when the admission prerequisites are fulfilled.
- (2) For every examination a separate notification in the Campus Management System at Paderborn University is necessary. The notification is made within the deadlines set by the Campus Management System. Examinations can be taken as soon as the performance requirements for admission are proved.
- (3) The oral substitute examination according to § 20, paragraph 2 has to be registered in written form at the central examination office.

§13 Completion of a module

- (1) Every module is completed with a module examination and, if applicable, intended qualified participation. A module examination usually consists of an examination at the end of a module (module final examination). The module examination can also consist of several partial examinations (module partial examination). If a module consists of several partial examinations, every partial examination has to be passed. The module grade is equivalent to the grade reached in the module examination.
- (2) Credit points can be gained when the module has been successfully completed. The module is successfully completed when the module final examination, or all module partial examinations, have been assessed with at least a "satisfactory", and the intended qualified participation has been proved.

§14 Examination performances in modules

(1) In modules, performances in examinations are taken according to the module description. The grades of the module examinations contribute to the total grade of the Master's examination, except for the grades in the extracurricular studies module. They are weighted according to the gained credit points.

(2) As far as specifications about the form and / or duration / scope of performances in examination are included in the module descriptions, the examination board sets in detail, in consultation with the examiners, how the performances in examination have to be performed. In all courses, not later than the

third week after the beginning of the term, the professors announce how the performances in examination can be made. This counts as well for the proof of the qualified participation. The performances in examination relate in each case to the content and competencies of the related courses.

(3) All examinations are taken study-related. The examinations usually are given two times within an academic year.

§15 Forms of performance in examinations, study performances and qualified participation

(1) Performances in examination can be made in the form of written examinations, oral examinations, written term papers, or in other forms. The detailed description of the individual performances in examination can be looked up in the addendum II and the module descriptions. The assessment results have to be announced to the students not later than six weeks after the performance, in the Campus Management System of Paderborn University, except for oral examinations.

(2) It is distinguished between the following forms of examinations:

a) In *written examinations* the candidate is expected to demonstrate that she or he is able to recognize problems in the relevant subject area, and solve them by standard methods within a set time using the resources permitted by the examiner. A list of permitted resources is issued at the same time as the announcement of the examination date. The length of a written examination is determined by the number of credits attached to the relevant classes. It is 60 to 120 minutes for classes with up to five credits, and 120 to 240 minutes for classes with more than five credits. Every examination is assessed by one examiner. In the case of a repeating examination the assessment is made by two examiners.

b) In *oral examinations* the candidate is expected to demonstrate her or his understanding of the relationships within the area examined, and to be able to categorize particular issues within these relationships and find solutions within a set time. Oral examinations are normally taken either as group examinations, or as individual examination with two examiners, or one examiner in the presence of an assessor. In each case it has to be possible to clearly differentiate and assess the contribution of each candidate which is counted as a performance in examination. Before determining the mark, the examiners confer, or the single examiner hears the assessor's remarks in the candidate's absence. In the case of the last retake the evaluation is done by two examiners. The length of oral examinations depends on the number of credits for a module. An oral examination takes 20 to 30 minutes for a module with 5 credits, and 30 to 45 minutes for a module with more than 5 credits. The time for group examinations may be extended appropriately. The main subject-matters and results of the examination are recorded in an examination protocol. The candidate is told by the examiners the result of the examination after completion of the oral examination.

Students who want to take the same examination at a later date will be admitted as listeners according to special conditions, as long as a candidate doesn't disagree. Admission doesn't extend to the consultation and announcement of the examination result.

c) A *presentation* is a talk of at least 30 minutes but no more than 60 minutes, based on a written elaboration. It is to show that students are able to work out a scientific subject, taking into consideration the interconnections within the subject area, and present the results orally.

d) In a *term paper* with a scope of 10 DIN-A4 pages, a subject relevant to a specific course is addressed in an appropriate manner, utilizing relevant literature and resources, and a qualified solution presented. The performance can be made as a group performance, as long as an individual assessment of each student's part is possible.

e) In a *colloquium*, students are to prove, in a discussion of 20 to 30 minutes with the examiner and other participants of the colloquium, that they are able to recognize / identify a subject-related context and place specific problems into this context.

f) In a *project work*, students work on a topic given by the professor, by themselves or in a group. Project works usually contain a design and the structure of Hardware and Software Prototypes, as well as an experimental assessment. Other parts of a project work usually are technical documentation and the presentation of the work and its results.

(3) A *qualified participation* exists when the rendered performances show that a more than superficial work has been done with the topics, which underlie the task. The proof of the qualified participations in a module can be requested when this is necessary to secure gaining competences in a module besides the module's examination. The proof of the qualified participation in a module can be a requirement for the award of credit points, or a requirement for the participation in performances in examination. The proof of the qualified participation is made especially by:

- One or more short examinations,
- An expert discussion,
- Creating of a protocol,
- Editing of presence and homework,
- Confirmations of attendance,
- A presentation.

§16 Evaluation of performances in modules

(1) The grades for individual performances in examination are determined by the respective examiner. Performances in examination are to be graded as following:

- 1 = very good: an excellent performance
- 2 = good: a performance which lies significantly above the average requirements
- 3 = satisfactory
- 4 = sufficient a performance which matches the requirements despite its deficiencies
- 5 = unsatisfactory: a performance which doesn't match the requirements because of its deficiencies

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

(3) If a performance in examination is assessed by several examiners, the grade is built by arithmetic mean of the individual grades. Furthermore paragraph 4, sections 2 and 3 count accordingly.

(4) If a module grade is built out of several grades, according to the workload of the component courses, the arithmetic mean is to be built. The result is to be cut after the first decimal after the comma. The grade is:

- At an average below and 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 = sufficient
- At an average above 4,0 until 5,0 = unsatisfactory.

- (5) In addition to the performances in examination, performances can be made voluntarily within a bonus system (bonus), which can be assessed and can improve module grades by a determined procedure. The bonus has to be made study-related, and only in relation with a concrete course. As forms of performances homeworks, short presentations, project work or interim tests are permitted. The bonus shall successively prepare the students for the following performances in examination. If bonus can be achieved in a course, and the possible procedure serves for improvement of the module grade as determined by the examination board in consultation with the respective professor, then this announced not later than in the third week after the beginning of lectures. The module's examination has to be passed independently of the bonus. The bonus can improve the module grade by a maximum of 0,7 in total.
- (6) The qualified participation has to be proved.

§17 Module Master Thesis

- (1) The Master's thesis module consists of a work plan (qualified participation according to § 15, paragraph 3, workload 150 hours) and the Master's thesis, including the interim presentation and a final presentation (workload 750 hours).
- (2) The Master's thesis is a completed script which completes the scientific training, and shall demonstrate that the candidate has the ability to work on a problem in Electrical Systems Engineering with the help of scientific methods within a determined period of time. The task for the thesis module is designed in a way in which it is equivalent to a workload of 900 hours (30 credit points) in total. The written work should contain an appropriate presentation of the Master's thesis topic, the obtained results and its classification within the rank of science. These usually need to have a scope of not more than 120 DIN A4 pages. The interim presentation usually takes 30 to 40 minutes. The final presentation takes between 45 and 60 minutes. The duration is six months.
- (3) The Master's thesis topic is provided and supervised by a person with inspector qualifications according to § 9, paragraph 1, who is called in by the examination board. The master's thesis can also be carried out outside of the University of Paderborn, as long as the topic is still provided and supervised by the person named in section 1.
- (4) The candidate has to have the possibility to make suggestions for the topic of the Master's thesis and for the choice of the first supervisor. The suggestions don't justify any legal claim.
- (5) On application, the chairperson of the examination board ensures that the candidate receives the topic for the Master's thesis on time. The distribution of the topic of the Master's thesis is made by the chairperson of the examination board. The moment of the distribution has to be documented at the central examination board.
- (6) The Master's thesis can also be permitted in the form of a group work, when the contribution which is to be assessed as a performance in examination of each candidate can be clearly distinguished and assessed according to the indication of paragraphs, page numbers or other objective criteria which enable a concrete delineation and fulfils the requirements according to paragraph 2.
- (7) The topic and task of the Master's thesis is communicated to the candidate in written form. The topic can be changed only once within the first month after the distribution. The time allowed for completion starts with the assignment of the new topic. In individual cases and on application of the candidate, the examination board can extend the time allowed for completion of the Master's thesis at six weeks at the

most, if the reasons for it are connected with the topic of the Master's thesis and the responsible supervisor supports it.

(8) In case of illness within the time allowed for completion, the deadline for the submission of the Master's thesis can be extended by four more weeks at the most. In addition, a doctor's certificate has to be handed in immediately. If there are further doubts about the candidate's inability to take examinations, then an additional doctor's certificate of a medical officer of Paderborn University can be appointed at the cost of the University. If the examination board grants the application, the candidate will be informed about it in written form. The extension is equivalent to the duration of illness; it doesn't signify an extension of the normal program length. If the illness exceeds four weeks, the candidate can either complete the thesis by the new deadline which was extended for four weeks, or request a new topic for the thesis. If the examination board declines the application, the candidate will also be informed about it in written form.

(9) It is not permitted to use a Master's thesis done for another examination in the same or another degree course, not even in part.

(10) When submitting the Master's thesis the candidate has to ensure in written form that she or he has written the thesis – in case of a group the relevant part of the thesis – independently and didn't use any sources as aid other than the ones indicated as well as identified in quotes in the thesis.

(11) 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 the submission of the Master's thesis there is a final presentation about the topic of the Master's thesis and its results.

§18 Acceptance and Assessment of the module Master's thesis

(1) The Master's Thesis has to be submitted to the central examination office on time and in a double copy (typewritten, tied and paginated), as well as once in electronic form. The date of submission has to be recorded in the central examination office. When delivering the thesis by mail the moment of delivery at the post office (postmark) is obligatory. If the Master's thesis is not submitted on time, it has to be graded with "unsatisfactory" (5,0).

(2) 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. For completion of the module and the award of credit points, the proof of the qualified participation in the form of a work plan is required. The qualified participation is determined by the first examiner according to § 16, paragraph 5.

(3) The Master' Thesis including the interim and final presentation, is peer reviewed and assessed by two examiners. Besides the first examiner according to § 17, paragraph 3, a second examiner is chosen by the examination board. The grade for the thesis is built by the arithmetic mean of the individual assessments, as long as the difference is smaller than 2,0 and the grades of the individual assessments are "sufficient" in each case. § 16, paragraph 4, sections 3 and 4 count accordingly. If the difference is 2,0 or more, or if one assessment is "unsatisfactory" but the other is "sufficient" or better, the examination board chooses a third examiner for the assessment of the Master's thesis (without the final examination). In this case the grade is built by the arithmetic mean of the two better grades. The thesis can only be assessed with "sufficient" or better when at least two grades are "sufficient" or better. § 16, paragraph 4, sections 3 and 4 count accordingly.

- (4) The Master's thesis is passed when at least the grade "sufficient" has been achieved. The assessment of the Master's thesis has to be communicated to the students not later than six weeks after the submission at the Campus Management System of Paderborn University.

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

- (1) The Master's examination is passed when all module examinations according to § 11 are assessed with at least a "sufficient" (4,0). The requirements for a successful completion of the studies are drawn from § 22.
- (2) The final grade is built by weighting all module grades relevant for the final grade according to credit points, and by building the arithmetic mean out of it. When calculating the result only the first decimal behind the comma is taken into account, all other digits are removed from the rounding.
The grade is:
At an average below and including 1,5 = very good
At an average of above 1,5 until including 2,5 = good
At an average of above 2,5 until including 3,5 = satisfactory
At an average of above 3,5 until including 4,0 = sufficient
At an average of above 4,0 until 5,0 = unsatisfactory
- (3) The overall judgement "passed with excellence" is given when the grade of the Master's thesis is 1,0, when the average of grades of the module examinations weighted according to credit points is 1,3 or better, and no module grade relevant for the final grade is worse than "good".

§20 Repetition of examinations, compensation

- (1) A passed examination cannot be repeated. Paragraph 3 remains untouched.
- (2) A failed examination can only be retaken twice. In case of a written examination, the second retake is replaced by an oral substitute test with the entire grade spectrum according to § 16, paragraphs 1 to 2.
- (3) A passed examination in the compulsory elective area, which is registered as an additional module according to § 21, can be exchanged for a passed or a not yet or finally failed examination upon request of the candidate (compensation). A compensation is possible in a chosen specialisation for a compulsory elective module within the chosen specialisation and in the remaining compulsory elective areas for another module.
- (4) A module examination is finally failed when the module final examination or a module partial examination can't be retaken or compensated.
- (5) A finally failed examination in the extracurricular studies can be retaken or be replaced by examination of another course. The amount of replacement possibilities as well as the amount of retakes is not limited.
- (6) The Master's thesis can be repeated only once in case of a performance assessed with the grade "unsatisfactory" (5,0). Then a new topic has to be provided. A second repeat is excluded. A further change of the topic of the Master's thesis according to the deadline mentioned in § 17, paragraph 7,

section 3 is permitted only when the candidate didn't make use of it during her or his first preparation of the Master's thesis.

- (7) For the retake of the Master's thesis the candidate can suggest another examiner. There is no legal claim.

§21 Withdrawal, cheating, infringement of regulation and protective instructions

- (1) A cancellation of examinations can be made until one week before the respective examination date at the latest without giving reasons, in the Campus Management System of Paderborn University.
- (2) An examination is deemed "unsatisfactory" (5,0) if the candidate fails to appear for an examination without good reason, or withdraws from the examination after the start of the examination without good reason, or after the end of the opt out deadline according to paragraph 1 without good reason. The same shall apply if a written examination is not taken within the time allowed.
- (3) The reasons put forward for absence or withdrawal must immediately be submitted to the Examination Board in writing without delay, and at the latest within five working days from the examination date and must be substantiated. If a candidate is ill, a medical certificate must be provided containing an assessment of his or her unfitness to sit the examination, or containing the information the Examination Board needs in order to establish the candidate's unfitness to sit the examination, which has to be handed in no later than a day before the examination. If there are further doubts about the candidate's inability to take the examination, a medical certificate of an independent medical examiner of Paderborn University can be requested at the university's expense. The illness of the candidate's child, verified by a medical certificate according to § 25, paragraph 5 of the Federal Law on Support for Education and Training, counts as an inability of the candidate to take an examination, when the care can't be guaranteed, especially in the case of sole care. If the Examination Board recognizes the reasons, the candidate will receive these in writing and a new examination date will be set. Already existing examination results are credited in this case. If the Examination Board doesn't accept the reasons, the candidate will learn about it in writing.
- (4) If a candidate deceives or tries to deceive, the concerning performance in examination has to be assessed with "unsatisfactory" (5,0). If a candidate brings a disallowed aid, the concerning performance in examination has to be assessed with "unsatisfactory" (5,0). The incidents have to be documented by the respective invigilator. The respective examiner makes the determination according to section 2.
- (5) A candidate who disturbs the proper procedure of the examination can be excluded from the continuation of the respective performance in examination by the respective examiner or the supervisor, usually after a warning. In this case the respective performance in examination has to be assessed with "unsatisfactory" (5,0). The reasons for suspension have to be recorded.
- (6) In serious cases the examination board can exclude the candidate from further performances in examinations. The actions of deception can lead to a fine of up to 50,000 €, according to HG § 63, paragraph 5, and can lead up 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 communicated to the candidate immediately in written form, explained and provided with an advice on legal remedies. Before the decision is made the candidate receives the chance for a fair hearing.

- (8) Furthermore, the examination board regulates the compensation of disadvantages for students with a disability or a chronic disease. If the student is unable to perform to the full extent or partially according to the intended modalities due to her or his disability, a compensation for disadvantage shall be granted. As a compensation for disadvantage, especially granting of organisational actions and aid, the extension of the examination time or the granting of another, equivalent form of giving a performance, come into consideration. Disability or chronic disease has to be attested. Here a doctor's certificate or a psychological report can be requested. The application of the student, or the examination board in agreement with the student, or the agent for students with a disability or chronic disease, can submit the recommendations for the design of the compensation of disadvantages.
- (9) It is taken into account the special situation of students with family responsibilities during the studies and while doing performances. This takes place inter alia in the following forms:
- a) On application of a candidate, protective rules according to §§ 3, 4, 6 and 8 of the Maternity Protection Law have to be taken into account. The necessary proofs have to be added to the application. The examination board can set other forms of taking examinations having regard to the individual case. The maternity leave interrupts every deadline according to these examination regulations; the duration of the maternity leave is not counted into the deadline.
- b) Also, on application, the deadlines for the parental leave have to be taken into account according to the respective Parental Benefit Act and Parental Leave Act. The candidate has to inform the examination board, not later than four weeks before the point in time when she or he wants to start the parental leave, with the needed proof in written form for which periods of time she or he wants to make use of. The examination board has to examine if the legal requirements exist, which causes an employee to make use of the parental leave according to the Parental Benefit Act and Parental Leave Act, and sets the dates and deadlines in consideration of the individual case. The submission deadline of the Bachelor's thesis can be extended at the most to twice the foreseen time allowed for the completion of the Bachelor's thesis. Otherwise the provided thesis is considered as not assigned and the candidate receives a new topic after the end of the parental leave.
- c) On application, the examination board takes into account idle time caused by care and education of children according to § 25, paragraph 5 of the Federal Law on Support for Education and Training, and idle time caused by taking care of the spouse, the registered life partner, the partner of a marriage-like community, or relatives related by marriage in the first degree, and sets the deadlines and dates in regards to the individual case. Otherwise sections 4 and 5 from letter b) count accordingly.

§22 Completion of studies, final failure

- (1) The studies are successfully completed when the Master's examination is passed and all modules are successfully completed. The Master's examination is passed when all module examinations as well as the Master's thesis are assessed with at least "sufficient" (4,0).
- (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 is given to the student in written form by the chairperson of the examination board. The notification has to be provided with an advice on legal remedies.

- (4) If a candidate has finally failed the Master's examination, she or he will receive a testimonial on application, which contains the gained credit points and indicates that the Master's examination has been finally failed.
- (5) Students who leave the university without a degree for other reasons have to receive a testimonial on application, which contains the gained credit points after deregistration.

§23 Additional modules

- (1) Beyond the performances required in § 11, paragraph 4, students can, additionally to the performances required within the Master's examination, take examination in additional modules with a scope of up to 24 credit points. Under the limit also fall failed examinations. Regulations for the modules with a limited number of participants according to § 59 HG remain untouched. The grades achieved in the additional modules are listed in the "Transcript of Records", unless the student requests until the submission of the thesis that these are not listed. They will not be taken into account at the formation of the final grade within the Master's examination.
- (2) Under observation of the limit set in paragraph 1, section 1, a change for the purpose of compensation according to § 20, paragraph 3 is possible. Under the limit also fall failed examinations.
- (3) The additional modules have to be identified at registration.

§24 Certificate, Transcript of Records and Diploma Supplements

- (1) If the candidate has successfully completed the degree program, he or she will receive a certificate containing the name of the degree program, the specialization chosen, the standard period of study, and the overall grade. The certificate is dated with the date of the last examination and, next to it, the date of issue. The certificate is signed by the Chair of the Examination Board. The certificate is written in English.
- (2) Furthermore, the candidate receives a Transcript of Records listing all of his / her successfully completed examinations and the length of his / her professional studies. The Transcript of Records includes information on credits (ECTS), and the grades awarded in the passed modules and the Master's thesis. It also includes the topic of the Master's thesis and the final grade of the Master's examinations.
- (3) Along with the leaving certificate, the graduate is handed a Diploma Supplement.
- (4) The Diploma Supplement is an addendum to the leaving certificate in English and German, containing information on German university degrees, explaining the German education system, and a classification of the degree at hand. The Diploma Supplement informs about the completed degree program, and the academic and professional qualifications obtained with this degree.

§25 Degree certificate

- (1) Along with the certificate of the passed Master's examinations, the candidate shall receive the Master's Degree certificate with the date of issue. There the award of the Master's degree according to § 2 is certified.

- (2) The Master's Certificate is signed by the Dean of the Faculty for Electrical Engineering, Computer Science and Mathematics and by the Chair of the Examination Board and bears the official seal of Paderborn University.
- (3) The Master's Certificate is written in English.

§26. Inspection of examination files

- (1) The candidate will receive the possibility to have an insight into her or his written performances after the announcement of the grades and the assessment of the examiners related to it. The chair of the examination board decides about the place and time of the inspection; he or she can delegate these tasks to the examiners. Place and time for the inspection will be given either during the examination, but no later than after the announcement of the grade.
- (2) As long as paragraph 1 isn't applied on application, and not later than one month after the announcement of the results of the respective examinations, the candidate is granted an insight into her or his written performances, the related assessments of the examiners, and the examination protocols. Within one year after the handing over of the certificate, the candidate is granted on application within an appropriate period of time an insight into the Master's thesis, the related expert opinion of the examiners, and the examination protocols. The chair of the examination board decides about the place and time of the inspection; he or she can delegate these tasks to the examiners.

III. Final Provisions

§27 Invalidation of Master's Examination

- (1) If a candidate has cheated in an examination and this is only discovered after the certificate has been issued, the Examination Board may a posteriori adjust the marks for the examinations in which the candidate cheated and declare the examination wholly or partly failed.
- (2) If the conditions of admission to an examination were not fulfilled, but without any deceitful intent on the candidate's part, and if this is only discovered after issue of the certificate, this deficiency is remedied by passing the examination. If the candidate has intentionally and wrongfully obtained admission, the Examination Board shall decide on the legal consequences with regard to the Administrative Proceedings Act of the state of North Rhine–Westphalia.
- (3) The person concerned has to be given an opportunity to make a statement before a decision is made.
- (4) The incorrect certificate is withdrawn and a new one issued if appropriate. Any decision according to paragraph 1 and paragraph 2 clause 2 herein above has to be made within five years from issue of the examination certificate.
- (5) If the examination as a whole is declared failed, the Master's degree is nullified and the relevant certificate withdrawn.

§28 Nullifying of Master's Degree

The Master's degree is nullified if a posteriori it turns out that it was gained by cheating or if essential conditions for its award were mistakenly considered to be fulfilled. The nullification decision is taken by the Faculty Council with two-thirds of its members. The deprivation of the Master's degree is only permitted within five years starting from the moment of the award of the degree.

§29 Transition regulations

- (1) These examination regulations apply for all students who are first-time enrolled in the winter term 2017/18 for the Master's program Electrical Systems Engineering of the faculty for Electrical Engineering, Computer Science and Mathematics at Paderborn University.
- (2) Students who have been enrolled at Paderborn University for the Master's program Electrical Systems Engineering before the winter term 2017/18 can take the Master's examination, including the repeating examinations, according to the version of April 30th 2012 (AM.Uni.PB 12/12), changed by the constitution of October 31st 2014 (AM.Uni.PB 160/14) and the constitution of March 16th 2016 (AM.Uni.PB 14/16), for the last time in the summer term 2020. Starting from the winter term 2020/2021, the Master's examination including the repeating examinations are taken according to these examination regulations.
- (3) On application students can switch into these examination regulations. The change is irrevocable.

§30 Effective Date and Publication

- (1) These examination regulations come into force as of October 01st 2017. At the same time the examination regulations of April 30th 2012 (AM.Uni.PB 12/12), changed by the constitution of October 31st 2014 and the constitution of March 16th 2016 (AM.Uni.PB 14/16), cease to be in force. § 29 remains untouched.
- (2) These examination regulations are published in the Official Communications of Paderborn University (AM.Uni.PB).

Issued on the basis of the decision of the Faculty Council of the Faculty of Electrical Engineering, Computer Science and Mathematics, dated September 18th 2017, and with legality check by the Executive Board on September 27th 2017.

Paderborn, October 30th 2017

The President
In name and representation
The Vice president for Economic Administration and
Human Resources of Paderborn University

Simone Probst

Appendix A: Syllabus / Course Timetable

Each of the following illustrations show an exemplary course timetable for the specializations

- Electronics & Devices and
- Signal & Information Processing

of the Master's program Electrical Systems Engineering with its modules and credit points (CP) per module. Modules or module groups are listed, each with indication of timetabled study hours (Presence Time) and the workload. The total weekly presence time and the achievable credit points are listed per semester.

MS Electrical Systems Engineering Specialization: Electronics & Devices			
1. Semester 20 SWS, 30 CP	2. Semester 20 SWS, 30 CP	3. Semester 20 SWS, 30 CP	4. Semester 30 CP
Introduction to ESE Compulsory subject Advanced System Theory (4 SWS, 6 CP)	Intro. to Electronics & Devices Compulsory subject E&D Fields & Waves (4 SWS, 6 CP)	Electronics & Devices Compulsory elective (4 SWS, 6 CP)	Master Thesis
Introduction to ESE Compulsory subject Modeling & Simulation (4 SWS, 6 CP)	Electronics & Devices <i>Compulsory elective</i> (4 SWS, 6 CP)	Electrical Systems Engineering <i>Elective</i> (4 SWS, 6 CP)	
Intro. to Electronics & Devices <i>Compulsory subject</i> E&D Circuit & System Design (4 SWS, 6 CP)	Fundamentals of ESE <i>Compulsory elective</i> (4 SWS, 6 CP)	Electrical Systems Engineering <i>Elective</i> (4 SWS, 6 CP)	
Fundamentals of ESE <i>Compulsory elective</i> (4 SWS, 6 CP)			
Management and Application <i>Compulsory subject</i> Management of Technical Projects (2 SWS, 3 CP)	Projects <i>Elective</i> Analysis / Design (6 SWS, 9 CP)	Projects <i>Elective</i> Realization / Test (6 SWS, 9 CP)	
General Studies <i>Elective</i> Language Course German or Other	General Studies <i>Elective</i> Language Course German or Other	Management and Application <i>Compulsory seminar</i>	

(2 SWS, 3 CP)	(2 SWS, 3 CP)	Topics in System Engineering (2 SWS, 3 CP)	(30 CP)
Abbreviation: SWS: Hours per week CP: ECTS credits			06.01.2016

Appendix B: Module lists

As a result of the development of the research and course content of the institute *Electrical Engineering and Information Technology*, modules can lapse in small number or be replaced or complemented by modules which professionally belong to the same area. The changes are announced in the module guide. The regulations for the performances, the scope, as well as the requirements for participation remain untouched.

Module group Courses (LV)	LP Module SWS LV	Number and Form of Examinations	Note
Module group <i>Introduction to Electrical Systems Engineering</i>	6	2 oral examinations, written examinations or presentations as final module examinations	2 Compulsory modules
Advanced System Theory Modeling & Simulation	2+2		
Module group <i>Introduction to Electronic & Devices</i>	6	2 oral examinations, written examinations or presentations as final module examinations	2 Compulsory modules for specialisation <i>Electronics & Devices</i>
<i>Circuit & System Design</i> <i>Fields & Waves</i>	2+2		
Module group <i>Introduction to Signal & Information Processing</i>	6	2 oral examinations, written examinations or presentations as final module examinations	2 Compulsory for specialisation <i>Signal & Information Processing</i>
Statistical Signal Processing Statistical Learning & Pattern Recognition	2+2		
Module group <i>Fundamentals of Electrical Systems Engineering</i>	6	2 oral examinations, written examinations or presentations as final module examinations	Election of 2 Compulsory Elective modules
Advanced Control Introduction to Algorithms Digital Speech Signal Processing High-Frequency Engineering Mechatronics and Electrical Drives Software Engineering	2+2		
Module group <i>Management and Application</i>	3	2 oral examinations, written examinations or	2 Compulsory modules

Management of Technical Projects Topics in Systems Engineering	2	presentations as final module examinations	
Module group <i>Electronics & Devices</i>	6 2+2	2 oral examinations, written examinations or presentations as final module examinations	2 Compulsory elective modules for Specialisation <i>Electronics & Devices</i>

Module group <i>Signal & Information Processing</i>	6 2+2	2 oral examinations, written examination or presentations as final module examinations	2 compulsory elective modules for specialisation <i>Signal & Information Processing</i>
Module group <i>Electrical Systems Engineering</i>	6 2+2	2 oral examinations, written examination or presentations as final module examinations	2 compulsory elective modules
Project group	18 6	Project work	Compulsory elective module
Thesis	30	see § 17	Compulsory module; The proof of the qualified participation according to § 15 (3) in the form of a work plan is the requirement for the completion of the module and the award of credit points
Work plan			
Master's thesis			

Module group *Signal & Information Processing*

- Advanced Control Methods for Mechatronics
- Advanced Topics in Robotics
- Algorithms and Tools for Test and Diagnosis of Systems on a Chip
- Cognitive Systems Engineering – Special Topics
- Digital Image Processing I
- Digital Image Processing II
- Dynamic Programming and Stochastic Control
- Numerical Simulations with the Discontinuous Galerkin Time Domain Method
- Optical Waveguide Theory
- Optimal and Adaptive Filters
- Robotics
- Topics in Pattern Recognition and Machine Learning
- Topics in Signal Processing
- Wireless Communication

Module group *Electronics & Devices*

- Advanced VLSI Design
- Analog CMOS ICs
- Controlled AC Drives
- Energy Transition
- Fast Integrated Circuits for Digital Communications
- High-Frequency Electronics
- Integrated Circuits for Wireless Communications
- Micro-Electromechanical Systems
- Numerical Simulations with the Discontinuous Galerkin Time Domain Method
- Optical Communication A
- Optical Communication B
- Optical Communication C
- Optical Communication D
- Optical Waveguide Theory
- Power Electronic Devices
- Power Electronics
- Processing of Semiconductors
- Radio Frequency Power Amplifiers
- Sensor Technology
- Solar Electric Energy Systems
- Switched Mode Power Supplies
- System Technology for Renewable Energy and Battery Systems
- VLSI Testing

Module group *Electrical Systems Engineering*

Compulsory elective modules from

- Module group *Signal & Devices*
- Module group *Electronics & Devices*
- Compulsory module groups of the respective other specialisation