

Official Communications

Promulgating Publication of the University of Paderborn Am.Uni.PB

Edition 107.17 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 the University of Paderborn

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

this is a non-official document

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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 it 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.

§4 Licensing requirements

- (1) Admission to the Master's program in Electrical Systems Engineering is open to anyone cumulatively meeting 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 an university degree and fulfils the following requirements:
 - a) Hold a first university degree qualifying for a profession obtained at an university within the jurisdiction of the German Basic Law in the standard period of study of at least 6 semesters 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. As far as 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 system has to be addressed. 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 |
| Field Theory | at least 5 CP |
| Signal Theory | at least 4 CP |
| System Theory | at least 4 CP |

The examination board makes the determination about the requirements. If credit points are missing, the enrolment can be made under the conditions of making up for the requirements by appropriate studies and be proved by passing the associated examinations up to the registration for the master's thesis. The examination board makes the decision about this as well as about the type and the scope of the studies and examinations on the basis of the previous qualification. The studies which are missing or have to be caught up on are only allowed to affect the areas of Signal, System 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 foreign prospective students who aren't equal to Germans through or due to treaties under international law and proof her or his ability to study by results of a GRE Revised General Test. In the part "Quantitative Reasoning" usually at least 157 points are necessary and at least 4,0 points in the part "Analytical writing" of the GRE Revised General Test. In case of a very good or good final grade of the qualification according n° 2 the proof of the GRE Revised General Test is not necessary. Prospective students with a German university entrance qualification are excluded from the 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

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

Tests similar in the level.

(3) Enrolment has to be declined, if

- a) The requirements named in paragraph 1 – 2 are not fulfilled or
- b) The candidate has definitely failed an examination which is required according to the examination regulations in the desired degree at an university within the scope of the basic law or
- c) The candidate has definitely failed an other examination required according to the examination regulations in the desired degree at an 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 the University of Paderborn but also the definitely failed examination shows a considerable content-related closeness to an examination of a compulsory module of the master's program Electrical Systems Engineering of the University of Paderborn. The examination board makes the determination about the considerable content-related closeness.

§5 Prescribed period of study and extend 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), among those are compulsory modules with a scope of 30 CP, compulsory elective modules with a scope of 36 CP, a two semester project module with a scope of 18 CP, the extracurricular studies module with a scope of 6 CP and the master's thesis module with a scope 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 content 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 addendum A, B and C. The module guide reflects the current status 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 in the normal program length.
- (6) The extracurricular studies module has to be covered with courses beyond the field of Electrical System Engineering. It is recommended to students without sufficient German language skills to chose two German language courses within the extracurricular studies.

§6 Modules

- (1) The master's program Electrical Systems Engineering is offered in a modularised form. Modules are thematically and temporally rounded, completed in oneself and provided with credit points, examinable, independent qualification units. Modules have a scope of at least 3 – 18 CP (with 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) Performances which have been made in other degree programs or in degree programs at other state or state-approved higher education institution, 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 regarding the gained competences there is no significant difference regarding the performances which are replaced. No schematical comparison has to be made, but an overall view regarding the purpose of accreditation of the continuation of the studies and taking of examinations. For the accreditation of performances in state-approved distance learning programs or in distance learning programs units developed by the state North-Rhine Westphalia with other states and the federal government section 1 and 2 apply accordingly.
- (2) For the accreditation of performances 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 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. Besides in case of doubts about presence or absence of significant differences the central office for foreign education system can be addressed.
- (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 the studies due to an entrance examination according to § 49, paragraph 12 HG, proved in the entrance examination will be accepted for performances. 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 skills and qualifications are equivalent in content and level to the performances, which have 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 responsible expert representatives have to be consulted. If the recognition is refused, it has to be explained.

(7) The applying person has to submit information (especially knowledge and skills gained through performances and examination results) necessary for the recognition in a form determined by the examination board. The examination board has to decide about the applications according to paragraph 1 not later than ten weeks after complete submission of all relevant information.

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

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

§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 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 compliance of the accomplishment of examinations of approved regulations of procedures,
- Decisions about contradictions against decisions 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 don't have a fundamental meaning to the chairperson; this doesn't count for decisions about contradictions 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 respective group the chairperson, the representative chairperson and two more members from the group of professors, one member from the group of the academic employees and two members from the group of students are elected into the faculty executive committee by their respective representatives. In accordance with it 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 takes two years and last 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 takes one year and last 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 tie 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. As an assessors can be called in 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, 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 the University of Paderborn 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 at 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 regulations can be used once only, meaning that the process of pulling forward is not possible anymore when an admission to the pulled forward master modules, also beyond the degree program, has taken place. Repetition 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 to a later date.

(3) The Master 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 requirements mentioned in paragraph 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". In 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 performances in examination are credited as far as possible.
- (4) The Master's examination consists of the following study-related module examination:
 - 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 Theory* 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 *Electrical & 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 System 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 *Electrical & Devices*:

2 compulsory elective modules from the module groups *Electrical & 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 modules *Projects* with 9 credit points in 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 forms of the examinations are added to these examination regulations in the addendum. On application the examination board can permit another course in an individual case. In this case he 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 the University of Paderborn 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 the University of Paderborn is necessary. The notification is made within the deadlines set by the Campus Management System. Examinations can be taken as soon as the performances required for admission are proved.
- (3) The oral substitute examination according to § 20, paragraph 2 has to be registered in written form in the central examination office.

§13 Completion of a module

- (1) Every module is completed with a module examination and eventually intended qualified participation. The module examination takes places in a temporal context with the module. A module examination usually consists of an examination in 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 finale examination when all module finale examination or all module partial examinations have been at least assessed with a "satisfactory" and the eventual intended qualified participations have 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 flow into the total grade of the master's examination except of the grades in the extracurricular studies module. They are weighted according to the gained credit points.

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

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

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

(1) Performances in examination can be made in 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 has to be announced to the students not later than six weeks after the performance in the Campus Management System of the University of Paderborn except in the oral examination.

(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. Every examination is assessed by one examiner. In the case of a repeating examination the assessment is made by two examiners. 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.

b) In the *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 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 repetition 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 the spatial conditions, as far as a candidate doesn't disagree. Admission doesn't extend on 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 interconnection 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 present a qualified solution. 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 upon a topic given by the professor by themselves or in a group. Project works usually contain a draft 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 just a 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 beside 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 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 or,
- 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:

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| 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 = imperfect: | 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 build by arithmetic mean of the individual grades. Furthermore paragraph 4, sections 2 and 3 count accordingly.
- (4) If a module grade is build out of several grades, according to the workload of the according courses the arithmetic mean has to be built. The result is to be cut after the first decimal after the comma. The grade is:
 - At an average of 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 = imperfect.
- (5) In addition to the performances in examination performances can be made volunaterly within a bonus system (bonus), which can be assessed and can improve module grades determined 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 an interim tests are permitted. The bonus shall successively prepare the students for the following performances in examianition. If bonus can be achieved in a course and the possible procedure serves for improvement of the module grade is determined by the examination board in consultation with the respective professor and is announced not later than in the third week after the beginning of lectures. The module's examination has to be passed independently from the bonus. The bonus can improve the module grade maximum at 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 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 is supposed to contain an appropriate presentation of the master's thesis topic, the reached results and its classification within the rank of science. These usually need to have a scope of not more than 120 DIN A4 page. The interim presentation usually takes 30 to 40 minutes. The final presentation takes between 45 and 60 minutes. The machining time is six months.
- (3) The Master's thesis 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 receive 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 cares for the candidate receiving 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 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 delimitation and fulfills 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 given back 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 mentor 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 on four more weeks at the most. In addition the doctor's certificate has to be handed in immediately. A doctor's certificate about the inability to take examinations. If there are sufficient actual indications, which let assume an inability to take examinations as probable or an other proof as appropriate, then a doctor's certificate of a medical officer of the University of Paderborn can be appointed on the costs 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 quit the 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 having used the Master's thesis, not even in part, done for an other examination in the same or an other degree course.
- (10) When submitting the Master's thesis the candidate has to assure 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 other sources as aid then the ones indicated as well as indentifies the quotes.
- (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 electronical form via a physical medium. 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 form of a work plan is required. The qualified participations 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 the assessment is "imperfect", but the others are "sufficient", 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 to 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 "satisfactory" 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 in the University of Paderborn.

§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 build by weighting all module grades relevant for the final grade according to credit points and by building the arithmetic mean out of it. When calculation the result only the first decimal behind the comma is taken into account, all other digits are removed from the rounding.

The grad is:

At an average of 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 and no module grade relevant for the final grade is worse than "good".

§20 Repetition of examinations, compensation

(1) A passed examination can't 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 grades 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 an other 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 another 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 return 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 in the Campus Management System of the University of Paderborn at the latest without giving reasons.
- (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 hers 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 not later than a day before the examination. If sufficient actual indications, which let assume an inability of taking an examination as probable or let another proof as appropriate, are there a medical certificate of an independent medical examiner of the University of Paderborn can be requested at the university's expense. The illness of the 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 when the care can't be guaranteed, especially in 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 not allowed 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 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 do performances in the full extend or partially according to the intended modalities due to her or his disability, a compensation for disadvantages shall be granted. As a compensation for disadvantages especially granting of organisational actions and aid, the extension of the machining time or the granting of another, equivalent form of giving a performance come into question. The 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 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 account of the special situation of students with family responsibilities during the studies and while doing performances. This takes places inter alia in 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 before she or he wants to start the parental leave with the needed proof in written form for which period of time or 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 of twice of 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 idle time caused by care and education of children in line of § 25, paragraph 5 into account of 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 a straight line of relatives or related by marriage in first degree and sets the deadlines and dates with having regard 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, which contains the gained credit points after deregistration on application.

§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 addition to 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, her 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 for 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 uniform 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 the University of Paderborn.
- (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 place and time of the inspection; he or she can delegate these tasks to the examiners. Place and time for the inspection have to be given during the examination, but not 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 into 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 into the examination protocols. The chair of the examination board decides about place and time of the inspection; he or she can delegate these tasks to the examiners.

III. Final Provisions

§27 Invalidity 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 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 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 the University of Paderborn.
- (2) Students who have been enrolled at the University of Paderborn for the Master's program Electrical Systems Engineering before the winter term 2017/18 can take the Master's examination including the repeating examinations in the summer term 2020 for the last time 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). Starting from the winter term 2020/2021 the Master's examination including the repetition examinations are taking 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 the University of Paderborn (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 the 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 Personnel
Management of the University of Paderborn

Simone Probst

this is a non-official document

Addendum 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 | Projects <i>Elective</i> Analysis / Design | Projects <i>Elective</i> Realization / Test | |

| | | | |
|--|--|--|------------|
| (2 SWS, 3 CP) | (6 SWS, 9 CP) | (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> Topics in System Engineering | |
| (2 SWS, 3 CP) | (2 SWS, 3 CP) | (2 SWS, 3 CP) | (30 CP) |
| Abbreviation: SWS: Hours per week CP: ECTS credits | | | 06.01.2016 |

Addendum B: Module lists

As a result of the development of the research and course content of the institute *Electrical Engineering and Information Technology* 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, about the scope as well as the requirements for participation remain untouched from it.

| 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 | | |
| Model 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 presentations as final module examinations | 2 Compulsory modules |
| Management of Technical Projects Topics in Systems Engineering | 2 | | |
| 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 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 groups *Electronics & Devices*

- Advanced VLSI Design
- Analog CMOS ICs
- Controlled AC Drives
- Energy Transition
- Fast Integrated Circuits for Digital Communications
- High-Frequency Electronics
- Intergrated 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