



**Official communication (*Amtliche Mitteilung*) 21/2021**

Examination regulations for the program  
Automation & IT leading to the academic degree  
Master of Engineering at the Faculty of Computer  
Science and Engineering Science at Technische  
Hochschule Köln - University of Applied Sciences

of January 7, 2021

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This is a translation of the original German document. For all legal purposes, only the German version of the examination regulations shall be considered binding.

**Technology**  
**Arts Sciences**  
**TH Köln**

Information:

Please note that in accordance with § 12 (5) of the North Rhine-Westphalia Higher Education Act (*Hochschulgesetz – HG NRW*), a violation of the formal and procedural requirements of the university's rules and self-governing laws cannot be asserted after one year has elapsed since this announcement, unless

- 1) the rules and regulations were not properly announced,
- 2) the Executive Board had previously objected to the decision of the body adopting the rules and regulations,
- 3) a complaint regarding the violation of the formal or procedural requirement had previously been made and in this complaint, the legal regulation violated was mentioned and the violating circumstances were described, or
- 4) at the time of publication of the rules and regulations, the legal consequences of the preclusion of complaint were not indicated.

Examination regulations  
for the program Automation & IT  
leading to the academic degree Master of Engineering  
at the Faculty of Computer Science and Engineering Science  
at Technische Hochschule Köln - University of Applied Sciences

of January 7, 2021

By virtue of §§ 2 (4) and 64 (1) of the North Rhine-Westphalia Higher Education Act (*Gesetz über die Hochschulen des Landes Nordrhein-Westfalen - Hochschulgesetz (HG)*) of September 16, 2014 (*Gesetz und Verordnungsblatt NRW (GV. NRW)*, p. 547), in the version of the law amending the HG of July 12, 2019 (*GV. NRW*, p. 425), as amended by Article 2 of the law of September 1, 2020 (*GV. NRW*, p. 890), Technische Hochschule Köln - University of Applied Sciences has adopted the following examination regulations by statute:

# Contents

<b>I</b>	<b>General information</b> .....	<b>3</b>
§ 1	Applicability of the examination regulations; module catalog and study plan .....	3
§ 2	Objectives of the program; purpose of examinations; academic degree .....	3
§ 3	Admission requirements .....	4
§ 4	Standard program duration ( <i>Regelstudienzeit</i> ).....	5
§ 5	Scope and structure of examinations; examination deadlines.....	5
§ 6	Examination board.....	5
§ 7	Rights and duties of the examination board .....	6
§ 8	Decisions by the examination board.....	6
§ 9	Examiners and co-examiners .....	7
§ 10	Recognition of examinations and assessments.....	7
§ 11	Evaluation of examinations.....	8
§ 12	Credits in accordance with the European Credit Transfer System (ECTS).....	8
§ 13	Evaluation of examinations in accordance with the ECTS grading scheme .....	9
§ 14	Retaking examinations .....	9
§ 15	Absence; withdrawal from examinations; cheating.....	9
<b>II</b>	<b>Module examinations</b> .....	<b>10</b>
§ 16	Objectives, length and type of module examinations .....	10
§ 17	Admission to module examinations .....	11
§ 18	Conducting module examinations.....	12
§ 19	Written examinations .....	13
§ 20	Written multiple-choice examinations .....	13
§ 21	Oral examinations.....	14
§ 22	Other types of examinations .....	14
<b>III</b>	<b>Progression of studies</b> .....	<b>15</b>
§ 23	Modules and completion of the program, additional modules .....	15
§ 24	Module examinations.....	16
<b>IV</b>	<b>Master's thesis and final oral examination</b> .....	<b>16</b>
§ 25	Master's thesis; purpose; topic; examiners.....	16
§ 26	Admission to the Master's thesis .....	17

§ 27 Assignment of the topic and writing the Master's thesis .....	17
§ 28 Submission and evaluation of the Master's thesis.....	18
§ 29 Final oral examination ( <i>Kolloquium</i> ) .....	18
<b>V Results of the Master's examination .....</b>	<b>19</b>
§ 30 Results of the Master's examination.....	19
§ 31 Examination certificate; final grade; diploma supplement.....	19
<b>VI Final provisions .....</b>	<b>20</b>
§ 32 Inspection of examination papers .....	20
§ 33 Invalidity of examinations.....	20
§ 34 Entry into force; transitional regulations.....	20
Annex 1: Study plan for full-time studies.....	22
Annex 2: Example study plan for part-time studies .....	23
Annex 3: Required documents for enrollment in the part-time program.....	24

## **I General information**

### **§ 1 Applicability of the examination regulations; module catalog and study plan**

- (1) These examination regulations are to administer studies and examinations of the Master's program Automation & IT at the Faculty of Computer Science and Engineering Science at Technische Hochschule Köln - University of Applied Sciences, Gummersbach Campus.
- (2) Based on these examination regulations, TH Köln establishes a study plan (annex 1) and a module catalog. The module catalog outlines the course contents, intended learning outcomes and structure of the individual modules, taking developments in the fields of science and university teaching as well as profession-specific requirements into account. The study plan provides students with a guideline for adequately scheduling their studies.
- (3) A part-time option of the program is available. The faculty has created an alternative study plan for part-time students in accordance with § 62a (2) of the North Rhine-Westphalia Higher Education Act (*Gesetz über die Hochschulen des Landes Nordrhein-Westfalen - Hochschulgesetz* (HG)).

### **§ 2 Objectives of the program; purpose of examinations; academic degree**

- (1) Students who pass the Master's examination are awarded a university degree qualifying them to exercise professional work in the field relevant to the program and entitling them to apply for admission to doctoral studies in accordance with § 67 (4) sentence 1, No. 3 HG.
- (2) Taking into account general study objectives (§ 58 HG), the degree program, which is to prepare students for the Master's examination, is designed to convey application-oriented topics of the discipline on the basis of scientific findings. It shall also enable students to critically analyze problems and assignments of automation engineering, to find constructively and economically justifiable solutions and, in doing so, be mindful of scientific principles as well as interdisciplinary perspectives. The program is designed to enhance the students' analytical and creative skills and to prepare them for their Master's examination. Moreover, the Master's program is to provide students with an opportunity to specialize in and delve deeper into an academic discipline.
- (3) The language of instruction is English.
- (4) The Master's program builds on the contents of the Bachelor's program in Electrical Engineering offered by Technische Hochschule Köln, Gummersbach Campus.
- (5) The Master's examination (§ 5) is to determine whether students have acquired further specialized knowledge required to exercise work in their profession independently (employability) and are prepared to assume social responsibility in a globalized world (global citizenship). It is also to determine whether they are capable of independently exercising work and conducting research on the basis of scientific findings and methods.
- (6) By passing the examinations listed in § 5, students will have completed a scientific degree program, qualifying them to exercise work in the designated profession. Based on the successful completion of all examinations, the academic degree "Master of Engineering" is awarded in accordance with the regulations stated hereinafter.

### § 3 Admission requirements

- (1) Admission to the Master's program requires the successful completion of a university program in Electrical Engineering, Computer Science & Engineering or another suitable program with at least a Bachelor's degree ("Bachelor of Engineering" or "Bachelor of Science") and a final grade of at least "good" (2.5) in the German grading system or its equivalent. The examination board decides on the suitability of a program. Additionally, applicants are required to provide proof of their English language proficiency (see subsection 4) as well as their aptitude for the program and their motivation for enrolling in the program (see subsections 5 and 6).
- (2) Studying part-time allows for flexible and individual study schedules under special circumstances (employment, childcare, illness or caring for a loved one, illness or disability, competitive sports, other social reasons). The reasons must be substantiated by appropriate evidence (annex 3). Students enrolled in the part-time program may not apply for admission or enrollment in another program or at another institution of higher education.
- (3) In exceptional cases, students may be admitted to the Master's program prior to having met the admission requirements stated in subsection 1 if they can provide proof of meeting the requirements within six months of the day of enrollment.
- (4) The language of instruction is English. Applicants therefore need to meet one of the following requirements:
  - a) Having passed the TOEFL with at least 550 points on the paper-based test, 213 points on the computer-based test or 80 points on the internet-based test.
  - b) Having passed the IELTS with 6.5 points.
  - c) Having passed an alternative language test with a test score equivalent to those of TOEFL or IELTS.
  - d) English as a native language.
- (5) Applicants who hold a suitable undergraduate degree (as stated in subsection 1, sentence 1) with a final grade that is worse than 2.5 (German grading system) may still prove their professional qualification for the admission to the Master's program if they meet the following requirements:
  - Proof of suitable professional experience of usually at least two years in a field relevant to the respective specialization of the program orA successfully conducted interview with the selection committee of at least 20 minutes duration.

In the case of deficiencies in qualifications that can be compensated, the committee may also offer conditional admission that requires students to obtain additional achievements of up to 30 ECTS. The type and scope of these examinations and/or coursework is determined by the selection committee.
- (6) Applicants are required to elaborately demonstrate their motivation for enrolling in the Master's program in a motivational letter of approx. two pages, written in English. The motivational letter is to be taken into consideration when determining a student's aptitude for the program. Applications submitted without a motivational letter are not considered.
- (7) Applicants participate in a selection procedure to determine their aptitude for the program. Based on the documents submitted as part of the application, the following criteria will be reviewed and assessed during the selection procedure:
  - a) Content of the previous degree program and its suitability
  - b) Previous coursework and examinations

- c) Academic and professional background
- d) Relevance of previous professional experience for the Master's program (if applicable)
- e) Personal motivation to pursue the Master's program (subsection 6)

Moreover, criteria-based, structured selection interviews may be conducted to determine a student's aptitude and motivation.

- (8) Admission is to be denied if the applicant has (within the jurisdiction of the German constitution) irreversibly failed (i.e. failed with no option to repeat) or lost the right to take an examination in the chosen program and if this examination is mandatory according to the examination regulations. This also applies to programs whose content has strong similarities to that of the program described in these examination regulations.

#### **§ 4 Standard program duration (*Regelstudienzeit*)**

- (1) The standard program duration for students enrolled in the full-time program (annex 1) is four semesters. The standard program duration for students enrolled in the part-time program (annex 2) is six semesters. In compliance with the European Credit Transfer System (ECTS), students are awarded a total of 120 credits (§ 12). The standard program duration includes the examination period.
- (2) Enrollment for new first-year students is only possible in the winter semester.

#### **§ 5 Scope and structure of examinations; examination deadlines**

- (1) The program is divided into individual modules. Detailed information on the structure of the program can be found in § 23 and the study plan (annex 1). A student's successful completion of the program is to be determined by the examinations taken throughout the program (module examinations) as well as the Master's thesis and final oral examination. Group examinations are permissible.
- (2) Module examinations are to be held immediately after the corresponding module has been concluded according to the study plan.
- (3) The progression of studies, examination procedures and study plan are to be designed in a way that makes it possible for students to take all required examinations within the standard program duration. In accordance with § 26, students adhering to the study plan are to have registered for the Master's by the end of the penultimate semester.
- (4) Examination procedures are to make allowance for the legal provisions for maternity and parental leave periods as well as the leave for the nursing and care of spouses, registered partners, relatives in direct line of descent or brothers and sisters-in-law if they are in need of nursing or care. Respective requests are to be submitted in due time before the examination. This also applies for students who can prove – by submitting a medical certificate or in a different manner – that they are in disadvantage due to a permanent physical disability or chronic disease.
- (5) The language of examination is English.

#### **§ 6 Examination board**

- (1) The Faculty of Computer Science and Engineering Science is to establish an examination board to be in charge of the organization of examinations and the arrangement of the duties assigned



to it by these examination regulations. The examination board shall be an independent body of the faculty.

- (2) The examination board is elected by the faculty council and is made up of seven persons:
  - a) chairperson and vice chairperson selected from the pool of professors;
  - b) two additional members selected from the pool of professors;
  - c) one member selected from the pool of academic staff;
  - d) two members selected from the pool of students.
- (3) Deputies are to be elected for all members of the examination board except for the chairperson and the vice chairperson. The members of the board employed in full-time positions at the university and their deputies have tenure of two years; the student members and their deputies have tenure of one year. Re-election is permissible.

## **§ 7 Rights and duties of the examination board**

- (1) The examination board is responsible for the organization of examinations. It ensures that the examination regulations are complied with and that examinations are conducted properly. In particular, it decides on objections brought forward against decisions that were made in exam-related matters.
- (2) Moreover, the board reports to the faculty council on developments related to examinations and the duration of studies, if so requested. It gives advice on potential reforms of the examination regulations, the module catalog and the study plans. The examination board may transfer its regular duties (in particular decisions on requests for withdrawals or credit transfers) to the chairperson or another member from the pool of professors of the examination board. This does not apply to decisions on objections.
- (3) The members of the examination board and a representative of the Executive Board have the right to be present during examinations. Exempt from this right are student members of the examination board who are to take the examination concerned during the same examination period.
- (4) Meetings of the examination board are not open to the public.

## **§ 8 Decisions by the examination board**

- (1) The examination board has a quorum if, in addition to the chairperson or vice chairperson, one member from the pool of professors and at least two additional members eligible to vote are present. Decisions require a simple majority. In case of a tie, the chairperson has the casting vote. Student members and research assistants do not contribute to decisions on matters related to education and academics, particularly when it comes to the recognition or other evaluation of examinations and coursework or the appointment of examiners or co-examiners. Moreover, student members of the examination board do not participate in the debate and decision-making on matters related to examination topics or their own examinations.
- (2) All members of the examination board, their deputies, the examiners as well as co-examiners are to be sworn to official secrecy. If they are not employed in the German public service, they are to be sworn to secrecy by the chairperson of the examination board.
- (3) Negative decisions of the examination board or its chairperson are to be reported to the respective student without delay. If necessary, the student shall be given the opportunity to be heard beforehand.

## **§ 9 Examiners and co-examiners**

- (1) The examination board appoints the examiners and co-examiners. A person may be appointed examiner if they hold at least the qualification that is to be determined by the examination or an equivalent qualification and – provided that no compelling reasons necessitate a divergence – have held an independent teaching position in the subject relevant for the examination. A person may only be appointed co-examiner if they have at least passed the corresponding Master's examination or a comparable examination, or hold a comparable qualification (qualified co-examiner). Examiners are independent for examination purposes.
- (2) If an oral examination is offered by more than one examiner, students may suggest one of them as their examiner. (Supplementary oral exams, if available in this program, are exempt from this rule.) Students may also suggest an examiner to be their thesis advisor. If possible, a student's suggestion is to be considered.
- (3) The examination board ensures that examination duties are split as evenly as possible among the examiners. The chairperson of the examination board ensures that the students will be notified of the names of their examiners in advance. This shall happen at the same time as the registration for the examination, i.e. usually at least two weeks before the examination or before the topic of the Master's thesis is assigned. Posting the information on the corresponding bulletin board or on an electronic examination management system is sufficient.

## **§ 10 Recognition of examinations and assessments**

- (1) Coursework and examinations completed within the jurisdiction of the Convention on the Recognition of Qualifications concerning Higher Education in the European Region of April 11, 1997 (BGBl. II 2007; p. 712 - Lisbon Recognition Convention) are to be officially recognized upon request if it can be proven that they do not considerably differ from the coursework and examinations required. The decision is to be made within six weeks of the submission of all required documents. If the recognition of such examinations and coursework is denied, the university is to issue a substantiated notification on this matter. If it has been proposed to reject the recognition request, the Executive Board may be asked to review the decision.
- (2) Examinations and coursework completed in degree programs outside the jurisdiction of the Lisbon Recognition Convention are to be recognized analogous to subsection 1 upon request.
- (3) Achievements that are not part of a degree program may be recognized as examinations or coursework upon request if they are equivalent to the examinations and coursework required. Such achievements may only account for up to half of the total number of coursework or examinations required for the successful completion of the program.
- (4) For examinations and coursework that have been recognized, students are awarded the number of ECTS credits detailed in the study plan (annex 1). In case of a partial recognition, the number of credits awarded is to be adjusted accordingly. Non-graded examinations taken at other universities or in other programs are to be recognized in accordance with subsections 2 and 3. They are to be identified accordingly on the examination certificate and are not accounted for in the calculation of the final grade.
- (5) Examinations and coursework completed in the same degree program or the same module at Technische Hochschule Köln are transferred automatically.
- (6) The examination board, or a person commissioned by the examination board, is to decide in all cases laid out in subsections 1 to 5. In cases of doubt, it is to consult the examiners responsible for the individual modules.

## § 11 Evaluation of examinations

- (1) Examinations are to be evaluated in a differentiated and comprehensible manner by means of grades. Individual components of the overall evaluation may remain non-graded. Non-graded modules are acceptable in exceptional cases. Upon request of the examination board, examiners are to explain the evaluation in writing. Grades for individual examinations are to be determined by the respective examiner.
- (2) Graded and any non-graded modules are listed in §§ 23, 24 and/or the study plan.
- (3) The following grades are to be used for the evaluation of examinations:

1.0/1.3	= excellent	=	an outstanding achievement
1.7/2.0/2.3	= good	=	an achievement well above average requirements
2.7/3.0/3.3	= satisfactory	=	an achievement that meets average requirements
3.7/4.0	= sufficient	=	an achievement that meets the requirements despite its shortcomings
5	= insufficient	=	an achievement that does not meet the requirements due to substantial shortcomings

Grades 0.7, 4.3, 4.7 and 5.3 do not exist.

- (4) Calculated grades that differ from the grades listed above are to be determined as follows.

up to 1.5	Grade: "excellent"
above 1.5 to 2.5	Grade: "good"
above 2.5 to 3.5	Grade: "satisfactory"
above 3.5 to 4.0	Grade: "sufficient"
above 4.0	Grade: "insufficient"

For the calculation of grades, only the first decimal is factored in; all other decimals are dropped without rounding.

- (5) If several examiners participate in an examination, they are to jointly evaluate the examination, provided that no other provisions are made hereinafter. Should the evaluations differ from one another, the grade is determined by the arithmetic average of the individual grades as set down in subsection 4.
- (6) An examination is passed if it is graded "sufficient" or better. If a module examination consists of several components (partial or individual examinations), the module is passed if all components are passed.
- (7) Examinations are to be evaluated and students notified of the results within six weeks of the examination. Posting the information on the corresponding bulletin board or on an electronic examination management system is sufficient. Students are to be notified of the results of their Master's thesis within eight weeks.

## § 12 Credits in accordance with the European Credit Transfer System (ECTS)

- (1) Credits are assigned to each module of the Master's program, which makes credit transfers in accordance with the European Credit Transfer System (ECTS) possible. Credits are a quantitative measure of the overall workload that averagely gifted students need to successfully complete a component of the program. This includes courses, preparation and follow-up work for a course, self-study as well as examinations and exam preparation.

- (2) The student workload required to complete the program as detailed in the study plan amounts to 60 credits per academic year. One credit equals a student workload of 25 to 30 hours, thus the workload for students enrolled in the full-time program is 750 to 900 hours per semester during the lecture period and the semester break. This equals 32 to 39 hours per week for 46 weeks a year.
- (3) Students only receive credits if they successfully completed a module. This means that students are awarded the total number of credits for every graded module examination, as defined in § 11 (2 and 6), that has been passed with a grade of at least “sufficient”, irrespective of the grade received for the examination. A total of 120 credits is required to successfully complete the Master’s program.
- (4) An overview of the number of credits assigned to the individual modules and to the Master’s thesis as well as final oral examination is provided in the study plan (annex 1 and 2). More detailed information can be found in the module catalog.
- (5) Complying with § 10, credits obtained in accordance with the ECTS at other institutions of higher education within and outside the jurisdiction of the German constitution are to be recognized with the number of credits assigned in the current program. In case of a partial recognition, the number of ECTS credits awarded is to be adjusted accordingly, cf. § 10 (4), sentence 2.

### **§ 13 Evaluation of examinations in accordance with the ECTS grading scheme**

In accordance with § 31 (1), the examination certificate issued to students at the time of graduation includes a grade distribution table which indicates the relative position of the student’s final grade. This grade distribution table is based on the requirements defined in the ECTS as well as on recommendations by the the Standing Conference of the Ministers of Education and Cultural Affairs (*Kultusministerkonferenz*) and the German Rector’s Conference (*Hochschulrektorenkonferenz*).

### **§ 14 Retaking examinations**

- (1) Students who do not pass the Master’s thesis or the final oral examination may retake each examination once. Module examinations may be retaken twice. It is recommended to retake failed examinations within one year of the failed attempt.
- (2) An examination graded at least “sufficient” may not be retaken.
- (3) Students who did not pass a module examination that is made up of several individual components or a combination of different types of examination, only need to retake the component that they did not pass.

### **§ 15 Absence; withdrawal from examinations; cheating**

- (1) An examination is deemed “insufficient” (5.0), or “not passed” for non-graded examinations, if a student fails to show up for an examination and is not able to present a good reason for their absence. An examination is also deemed “insufficient” if a student withdraws from it without good reason after the examination has begun or if they do not submit the examination within the foreseen time frame. Sentence 1 also applies accordingly if students fail to submit their Master’s thesis by the submission deadline.
- (2) Students who miss or withdraw from an examination must immediately report in writing to the examination board and present an explanation and appropriate evidence. In case of illness, students are required to submit a comprehensible medical certificate confirming that they are

incapable of taking an exam. Students who withdraw from an examination after its start are required to notify the proctor who will record the withdrawal in the examination records. If the examination board accepts the student's explanation, the student will be notified that they may request to register for the respective examination again.

- (3) If a student attempts to manipulate the result of their examination by cheating or by using unauthorized resources, the examination concerned will be graded "insufficient" (5.0) or "not passed". Carrying unauthorized resources may already be considered cheating. Unauthorized resources are all documents, electronic resources, electronic devices or other resources that are not explicitly allowed to be used during the respective examination. Students are required to identify other people's intellectual property (text passages, images, statistics, etc. by other authors from offline or online sources) adopted in their (written) papers or examinations as quotations (also refer to the *Richtlinien des Präsidiums der TH Köln zur Sicherung guter wissenschaftlicher Praxis und zum Umgang mit wissenschaftlichem Fehlverhalten* (Guideline by TH Köln's Executive Board on the assurance of good scientific practice and handling of academic misconduct) of January 8, 2016 in its current version). If any solution artifacts (e.g. program codes, technical drawings, technical or scientific models and simulations) developed by others are adopted into own technical solution documents without indicating the source, this is also considered plagiarism. Whether an examination may be retaken in cases of alleged plagiarism may be subject to meeting certain conditions, such as the successful participation in a seminar or workshop on academic writing.
- (4) Anyone who disrupts the proper course of an examination may be expelled from the examination by the examiner or proctor, usually after prior warning. In such a case, the examination concerned is to be graded "insufficient" (5.0) or "not passed". The reason for the expulsion from the exam is to be put on record (minutes of the exam). In this case, the expelled student may request that the decision be reviewed by the examination board. This also applies to the decisions of an examiner or exam supervisor in cases described in subsection 3. In case of alleged cheating, the chairperson of the examination board is entitled, without prejudice to the Administrative Procedures Act for North Rhine-Westphalia (*Verwaltungsverfahrensgesetz, VwVfG NRW*), to question the examinee to determine evidence on the matter. Examiners may be asked to participate in the questioning.
- (5) In case of repeated or otherwise serious cheating (e.g. major plagiarism, i.e. copying of longer text passages not marked as quotations, or the skillful concealment of plagiarism) the examination board may decide that the examination is deemed permanently failed and the student is to be removed from the student register.
- (6) In addition, acts of cheating may be considered an administrative offense and punished by a fine. Refer to § 63 (5) HG for details.

## **II Module examinations**

### **§ 16 Objectives, length and type of module examinations**

- (1) The program is divided into individual modules, each of which concludes with an examination. A module may extend over one or two semesters. The contents of a module may be taught in one or more courses with different methods of teaching and study. Pursuant to §§ 19 to 22, a module examination may be subdivided into several individual examinations of the same or different type. Based on the intended learning outcomes defined in the module description, examinations are to

determine if and to which extent students have achieved the intended learning outcomes of a module. Students may be required to be familiar with relevant contents of previous modules.

- (2) Courses and examinations may also be offered in English. Additional information is provided in §§ 23 and 24, the study plan (annex 1) and the module catalog.
- (3) The examination type depends on the requirements of the respective module. Admissible types of examination are written or electronic examinations (§§ 19 and 20) with the following durations: Examinations for modules with up to 3 ECTS may last up to 60 minutes, examinations for modules with up to 5 ECTS may last up to 90 minutes and examinations for modules with more than 5 ECTS may last up to 120 minutes. Oral examinations (§ 21) can be conducted with a duration of 20 to 45 minutes per examinee. Other types of examination (§ 22) as well as combinations of the aforementioned types of examination are admissible.
- (4) A student's total workload for module examinations which are made up of a combination of several types of examination is not to exceed the typical workload that a single type of examination would generate.
- (5) In consultation with the examiners and considering the studiability of the program and the module description, the examination board is to determine the examination type and modalities for each module, usually at the beginning of each semester, unless this is already defined in the study plan or module catalog. If an examination within a module consists of several components or a combination of different types of examination, the examination board shall also specify how the individual components are weighted. Pursuant to § 11 (5), the overall grade is the arithmetic average of the individual evaluations, unless other weighting factors have been established.
- (6) The examination board determines the examination period for written and oral examinations in consultation with the examiners usually one month before the examination period. The examination period is uniform and binding for all students who intend to take the respective module examination. Posting the information on the corresponding bulletin board or on an electronic examination management system is sufficient.
- (7) In case of other examination types, the examiner determines the examination schedule in the first quarter of the course and informs the examination board. The examiner is to announce the examination schedule within this period. Posting the information on the corresponding bulletin board or on an electronic examination management system or another system provided by the university is deemed sufficient. § 18 (1), sentences 2 and 3 do not apply.

### **§ 17 Admission to module examinations**

- (1) Participation in an examination requires prior admission to the examination. Students are to request their admission to examinations within the registration period determined by the examination board, using the electronic registration/withdrawal system provided by the Office of Student and Examination Services. In exceptional cases, students may alternatively submit a written registration request to the Office of Student and Examination Services. Students are to verify that their registration was properly recorded by checking the electronic examination management system.
- (2) Only individuals who are enrolled at Technische Hochschule Köln as regular or cross-registered students in accordance with § 52 (1) and (2) HG can register for examinations.
- (3) Students may be required to have passed preliminary assessments, lab courses, partial exams throughout the semester or other module examinations in order for them to be admitted to a module examination; see § 24 and the study plan (annex 1 and 2) for details.

- (4) The selection of required electives (*Wahlpflichtmodule*) in which the student intends to take examinations and that is listed in the registration request becomes binding with the registration. For all other matters, the regulations set down in subsection 6 apply.
- (5) For oral examinations, a statement whether the student objects to the presence of students of the same program as audience during the examination is to be submitted along with the registration request, or by a separate deadline set by the examination board.
- (6) Students may revoke their registration for a module examination using the electronic registration/deregistration system provided by the Office of Student and Examination Services or, in exceptional cases, in writing with the Office of Student and Examination Services up until one week prior to the set examination date. By doing so, students will not lose an examination attempt. If a student withdraws from their first attempt to pass an examination, the selection of a required elective as per subsection 4 is no longer binding.
- (7) Admission is denied if
  - a) the requirements stated in subsections 1 to 4 are not met, or
  - b) the student fails to submit all documents and does not submit missing documents by the date set by the examination board, or
  - c) the student has irreversibly failed (i.e. failed with no option to repeat), within the jurisdiction of the German constitution,
    - a Master's or other final examination in the same program or
    - a comparable examination in a program whose content has strong similarities to that of the program described in these examination regulations.

In all other cases, admission is only to be denied if the student has, within the jurisdiction of the German constitution, lost the right to take examinations in the same program at a different institution, e.g. by having failed to meet a deadline for retaking examinations.

## **§ 18 Conducting module examinations**

- (1) For the module examinations specified in §§ 19 to 21, normally one examination date per semester is to be scheduled. However, each examination is to be offered at least once a year. With the exception of examinations which take place throughout the semester, examinations are to be held within the examination periods set by the examination board and which are announced at the beginning of the semester or toward the end of the previous semester. Examinations are to be scheduled in such a way that no classes need to be canceled. Examination procedures are to be documented in detail. (This applies in particular to oral examinations including presentations.)
- (2) Students are to be notified of the individual examination dates and their admission to the examinations at least two weeks prior to the examination concerned. Posting the information on the corresponding bulletin board or on an electronic examination management system is sufficient.
- (3) Upon request, students are to identify themselves with a government-issued photo ID and their student ID card (MultiCa).
- (4) If a student – by submitting a medical certificate or in a different manner - substantiates that they are not capable of completely or partly taking the examination, coursework or admission test in its intended form or time frame due to a permanent disability or chronic disease pursuant to § 3 of the German Act on Equal Opportunities for Persons with Disabilities (*Behindertengleichstellungsgesetz*), the chairperson of the examination board decides, after due consideration, if, how and to what extent reasonable adjustments are appropriate. Applications for reasonable adjustments are to be submitted in due time (usually along with the registration

for the exam at the latest and at least two months before the exam, or by a date set by the chairperson of the examination board) along with all required supporting documents. The decision on the application is to be made within an appropriate time frame (usually within one month of the date of submission of the application or at least one month prior to the examination/the assignment of the topic). Consultation with the Representative for Students with Disabilities and Chronic Diseases is possible in accordance with § 62b HG. In exceptional cases, sentences 1 to 4 also apply to persons with temporary health impairments.

- (5) If a written or oral examination is the second retake of a module examination, module component or individually assessed component or an examination which concludes a program, it is to be evaluated by at least two examiners.
- (6) According to §§ 19 and 20, examination records are to be kept which shall include at least the names of the record keeper and exam supervisor and examinees, the start and end time of the exam as well as any unusual occurrences.

### **§ 19 Written examinations**

- (1) In written examinations, students are to prove that – within a limited time frame and with limited resources – they are capable of identifying topics and tasks stemming from areas covered by the module by means of common scientific methods of their subject area and solving them correctly.
- (2) A proctor is present during written examinations. The examiner decides whether students are allowed to use additional resources.
- (3) A written examination is normally drawn up by one examiner only. In specific cases, especially when a module examination covers several subject fields, the examination may also be drawn up by more than one examiner. In such a case, the examiners jointly determine how the individual components of the examination shall be weighted prior to the examination; each examiner evaluates the entire written examination irrespective of the individual components and their weighting. Due to the special character of a subject field, the examination board may alternatively determine that an examiner shall only evaluate that part of a written examination that covers their subject field. In such a case, the examination is evaluated based on the previously determined weighting of the individual components. § 18 (5) is to remain unaffected.
- (4) Examinations which make use of electronic resources are permissible. They are treated like written examinations. An electronic written exam (“eKlausur”) is a computer-based exam which is conducted using an exam software. It is drawn up, conducted and evaluated supported by information and communication technology. Electronic written exams are subject to technical feasibility and may be conducted in modules suitable for this type of examination upon request of the examiners and with approval of the examination board. Prior to the examination, students are given ample opportunity to get to know the electronic examination system. During electronic written exams, a person competent in the relevant field is to be present. This person also produces a written record of the examination (§ 18 (6)). It is to be ensured that the electronic data is kept and can be assigned to the individual examinees for the duration of the retention periods.

### **§ 20 Written multiple-choice examinations**

- (1) Written examinations may be completely or partly conducted as multiple-choice examinations. In multiple-choice examinations, students are asked to answer written questions under supervision by selecting the correct answers from a list of suggested solutions. Multiple-choice examinations may be held in modules suitable for this type of examination upon request by the examiners and with approval of the examination board.



- (2) The questions asked in examinations are to target the knowledge and skills taught in the module concerned and need to ensure reliable examination results.
- (3) It is the examiners' responsibility to determine the examination questions and the suggested solutions (examination exercises). It is to be recorded in writing which of the suggested solutions are accepted as correct answers.
- (4) The evaluation of a written examination is to include the following information:
  - a) the number of questions asked and the number of questions answered correctly by the student,
  - b) the minimum number of questions required to be answered correctly in order to pass the examination,
  - c) in case the examination was passed, the percentage by which the number of correctly answered questions exceeds the minimum requirements,
  - d) the grade obtained by the student.
- (5) When evaluating examinations, examiners are to pay attention as to whether a frequent occurrence of wrong answers to a specific question might indicate that the question was worded incorrectly. If it is determined after the examination that individual questions or possible solutions are erroneous, the examination exercises concerned will not be factored in. This reduced number of exercises is to form the basis of the evaluation. Reducing the examination exercises shall not put students at a disadvantage.
- (6) If only part of the examination is in multiple-choice format, subsections 1 to 5 only apply to this part of the examination. If sentence 1 does not apply to an independent part of the examination, the regulations described in subsection 4 letters b) to d) do not apply.

## **§ 21 Oral examinations**

- (1) With the exception of the cases defined in § 18 (5), oral examinations are to be held in the presence of an examiner and a qualified co-examiner (§ 9 (1)) or in the presence of several examiners (panel examination) as group examinations or individual examinations. If an examination covers several subject fields, each student is examined by only one examiner in each subject field unless § 18 (5) applies. Prior to grading the examination, the examiner is to consult with the co-examiner or the other examiners.
- (2) A written record of the essential topics and the results of the examination, in particular facts that are essential to the grading of the examination, is to be kept. The grade is to be reported to the students immediately after the examination.
- (3) Students enrolled in the same program are to be given the opportunity to be present at oral examinations as audience, provided that there is enough space and that no examinee has objected to this provision when registering for the examination. However, no audience is allowed during the examiners' consultation or during the announcement of examination results.

## **§ 22 Other types of examinations**

- (1) Besides written and oral examinations, other types of examination may be applicable for module examinations, in particular presentations, project papers, written outlines and presentations of case studies or a different proof of academic performance, which may include active participation, written outlines and/or presentations of exercises completed in laboratories or tutorials.
- (2) Other types of examination are usually evaluated by one examiner, unless § 18 (5) applies.

- (3) A term paper (e.g. case study or research paper) is to determine whether students are capable of independently completing a written technical assignment within a given time frame, using scientific and subject-related methods. The examiner determines the topic and length of the paper (e.g. number of pages of the main part) at the beginning of the semester.
- (4) An oral contribution (e.g. report, presentation) is to determine whether the examinee is capable of independently solving and adequately presenting a practice-based assignment by means of verbal communication within a given time frame, using scientific and subject-related methods. The examiner determines the duration of the oral report at the beginning of the semester. A written record of facts that are essential for the grading of the oral report is to be kept. The grade is to be announced to the student one week after the oral report at the latest.
- (5) A learning portfolio documents the student's development of skills and competencies by means of presentations, essays, excerpts from internship reports, table of contents of term papers, lecture notes, to do lists, research reports and other presentations of coursework and products of learning. The documents assembled in the portfolio are called artifacts. A learning portfolio can only be considered an examination subject if it is accompanied by a student's reflection (written, oral or video) on the significance of these artifacts for the learning objective which was previously announced by the examiner. As the semester proceeds and the learning portfolio is assembled, the examiner will provide feedback on the development and/or artifacts. For the examination, the learning portfolio is revised based on the examiner's feedback. It is usually submitted in a digital format.
- (6) Term papers and oral contributions in the form of a joint team project may be treated as an examination if the individual student's contribution to be evaluated as an examination is clearly distinguishable and can be assessed accordingly. In order to verify the student's contribution, identifiers such as passages, subject fields, page numbers (for term papers) or other objective identifiers allowing for a clear distinction are to be indicated. If the focus of the intended learning outcome of the joint team project is on working together as a team, an overall evaluation of the team project is possible.

### **III Progression of studies**

#### **§ 23 Modules and completion of the program, additional modules**

- (1) In all compulsory modules (required modules and required electives), students are to take module examinations as described in §§ 19 – 22. The program's modules are listed in § 24; the corresponding types of examination can be found in the study plan or module catalog, unless individually determined by the examination board (§ 16 (5), sentence 1). Modules can be selected according to the study plan. Additional information is available in the module catalog.
- (2) A student may take examinations in more modules than the ones needed to earn the required number of credits (additional modules). The results of these additional examinations may be listed on the examination certificate upon request of the student. However, they are not accounted for in the calculation of the final grade. If a student selects more than the required number of modules from the catalog of required electives and concludes them by passing the respective module examination, these are also considered additional modules. In this case, those module examinations taken first are considered required examinations unless the examinee has specified differently prior to the first examination.

## **§ 24 Module examinations**

Students are required to take the following module examinations:

1. Industrial Communication and Information Security in Industrial Automation
2. Integration of Technical and Business Information Systems
3. Modelling and Simulation of Technical Systems
4. Control of Technical Systems
5. Optimization of Technical Systems
6. 3 Case Studies
  - a) Case Study Industrial Communication and Information Security (ICIS)
  - b) Case Study Integration of Technical and Business Information Systems (ITBS)
  - c) Case Study Modelling and Simulation of Technical Systems (MSTS)
  - d) Case Study Control of Technical Systems (CTS)
  - e) Case Study Optimization of Technical Systems (OTS)

Out of the five case studies listed, students must select three case studies, each of which is weighted with 10 ECTS credits.

7. Master's Thesis and final oral examination

## **IV Master's thesis and final oral examination**

### **§ 25 Master's thesis; purpose; topic; examiners**

- (1) The Master's thesis is a written paper. It is to demonstrate that students are capable of independently completing an assignment on a topic from their subject field within a given time frame by elaborating on subject-related specifics as well as on interdisciplinary contexts and by making use of scientific and subject-related methods. Interdisciplinary collaborations for Master's theses are possible. Examiners from other faculties may be chosen as thesis advisors if the topic of the thesis so allows.
- (2) The topic of the Master's thesis may be determined by any professor who may be appointed as examiner in accordance with § 9 (1). This examiner may also be the thesis advisor. Upon request of the student, the examination board may also name an honorary professor or a qualified adjunct lecturer as thesis advisor in accordance with § 9 (1) if it has been determined that no professor of the faculty is able to serve as thesis advisor for the intended topic of the Master's thesis. If approved by the chairperson of the examination board, students may write their Master's thesis at an institution outside the university if this institution provides sufficient advice and assistance. Students are to be given the opportunity to suggest topics for their Master's thesis.
- (3) Upon request, the chairperson of the examination board is to ensure that a student is provided with a topic for the Master's thesis in time.
- (4) A Master's thesis may also be written as a team project if students' individual contributions to be evaluated are clearly distinguishable and can be evaluated accordingly and if it complies with the requirements stated in subsection 1. In order to verify a student's contribution, their passages, page numbers or other objective criteria allowing for a clear distinction are to be identified.
- (5) The Master's thesis may be written in English if endorsed by the chairperson of the examination board and the main examiner.

## **§ 26 Admission to the Master's thesis**

- (1) Students are admitted to the Master's thesis if they meet the admission requirements stated in § 17 (2 and 5) and have, pursuant to § 12, obtained a total of 60 credits in the examinations required in accordance with § 24.
- (2) The registration for the Master's thesis is to be addressed in writing to the chairperson of the examination board and to be submitted to the Office of Student and Examination Services. Students are required to submit the following documents along with their registration request, unless they have already done so:
  - a) proof of having met the admission requirements stated in (1),
  - b) a statement on previous attempts to write a Master's thesis or another final examination and on attempts to pass the Master's examination,
  - c) a statement on which examiner is willing and able to prepare the topic of the Master's thesis and to function as thesis advisor, and
  - d) if applicable: the suggested topic of the Master's thesis.
- (3) Students may revoke their registration for the Master's thesis in writing up until the day the decision on admission is announced. In this case, the registration will not count as a failed attempt.
- (4) The chairperson of the examination board decides on the admission to the Master's thesis. In cases of doubt, the decision lies with the entire examination board. Admission is denied if
  - a) the student does not meet the requirements stated in subsection 1, or
  - b) the supporting documents are incomplete, or
  - c) within the jurisdiction of the German constitution, a final thesis written by the student has been evaluated as "insufficient" without option to repeat, or if the student has irreversibly failed one of the examinations stated in subsection 2 sentence 2 item b).

In all other cases, admission is only to be denied if the student has, within the jurisdiction of the German constitution, lost the right to take examinations in the same program, e.g. due to having failed to meet a deadline for retaking examinations.

## **§ 27 Assignment of the topic and writing the Master's thesis**

- (1) The topic of the Master's thesis is to be assigned by the chairperson of the examination board. The time of assignment is to be the day on which the chairperson of the examination board informs the student of the topic of the Master's thesis assigned by the thesis advisor. The time of assignment is to be put on record.
- (2) Students have 4 months to complete the Master's thesis (day of assignment to the day of submission). The topic and assignment must be such that it is possible to complete the Master's thesis within the given time frame. In exceptional cases, the chairperson of the examination board may extend the submission deadline by up to six weeks if the student concerned submits a request prior to the deadline, stating the reasons for extending the deadline. The thesis advisor is to be consulted on this request. The main part of the Master's thesis is not to exceed 100 pages.
- (3) Students may return a topic only once and only within the first two weeks of the assigned time frame. They are not required to state a reason for their withdrawal. If a student undertakes a second attempt to write a Master's thesis in compliance with § 14 (1), the student may only return their topic if they did not do so during their first attempt.
- (4) § 18 (4) applies accordingly.

## **§ 28 Submission and evaluation of the Master's thesis**

- (1) Students are to submit four hardcover copies of their Master's thesis and one copy – which is also used for plagiarism checks – on an electronic data carrier, or in another digital format, in one of the common word processing formats, to the chairperson of the examination board, or at a location determined by the chairperson, by the submission deadline. Submitting the thesis by means of telecommunication (e.g. by fax) is not permissible. The time of submission is to be put on record; if the thesis is submitted by mail, the decisive criterion is the point of time at which the thesis is submitted to the postal service. When submitting the thesis, students are required to declare in writing that they have written the thesis – in case of a team project their part of the thesis, which has been identified accordingly – without assistance and have used no other sources or resources than the ones indicated and stated in quotations.
- (2) The Master's thesis shall be evaluated by two examiners. One of the examiners is to be the thesis advisor. The other examiner is to be appointed by the examination board. If § 25 (2) sentences 2 and 3 apply, they must be a professor. If the examiners' evaluations differ from each other and the divergence of both grades is less than 2.0, the grade for the Master's thesis is the arithmetic average of the two grades. If there is a divergence of 2.0 or more, the examination board appoints a third examiner. In this case, the grade for the Master's thesis is the arithmetic average of the two better grades. However, the Master's thesis can only be graded "sufficient" or better if at least two of the grades are "sufficient" or better.
- (3) Students who pass the Master's thesis are awarded 30 credits in accordance with § 12.

## **§ 29 Final oral examination (*Kolloquium*)**

- (1) The final oral examination complements the Master's thesis. It is to be evaluated as an independent examination and is to take place within six weeks of the submission of the Master's thesis. Its aim is to determine whether the student is capable of orally presenting and independently justifying the findings of the Master's thesis, its scientific and methodological fundamentals as well as inter- and multidisciplinary contexts, and of assessing the thesis' significance for practice.
- (2) Students may only be admitted to the final oral examination if they
  - a) have passed all module examinations,
  - b) are enrolled at Technische Hochschule Köln (University of Applied Sciences) as regular or cross-registered students in accordance with § 52 (2) HG and
  - c) have received a grade of at least "sufficient" for their Master's thesis.
- (3) Students are required to file a written registration for the final oral examination with the Office of Student and Examination Services. Students need to submit proof of having met the admission requirements stated in subsection 2, unless such proof has already been presented to the Office of Student and Examination Services. In accordance with § 26, students may register for the final oral examination when they apply for admission to the Master's thesis; in this case, students are admitted to the final oral examination as soon as all required evidence and documents have been submitted to the Office of Student and Examination Services.
- (4) The final oral examination is usually conducted and evaluated by the examiners of the Master's thesis. If § 28 (2) sentence 6 applies, the final oral examination is conducted by those examiners whose individual evaluations were used to calculate the grade for the Master's thesis.
- (5) The duration of the final oral examination is approximately 45 minutes. The provisions laid down for oral examinations (section 21) apply accordingly.

- (6) Students who pass the Master's thesis and the final oral examination are awarded 30 credits in accordance with § 12. The grade is determined by the individual evaluations for the oral and written examination. The weighting for Master's thesis and final oral examination is 2 :1.

## **V Results of the Master's examination**

### **§ 30 Results of the Master's examination**

- (1) Students need to accumulate 120 credits to pass the Master's examination. This requires that all required module examinations have been passed and that the Master's thesis and the final oral examination have been evaluated as at least "sufficient".
- (2) Students have failed the Master's examination if one of the examinations stated in subsection 1 has been irreversibly evaluated as "insufficient" or is irreversibly deemed "insufficient". Students are to be notified (in writing) of having failed the Master's examination. This notification is to include information on legal remedies. After the student's removal from the student register, the chairperson of the examination board will, upon request, issue a certified document listing all examinations and coursework taken by the student and the respective grades, as well as the examinations missing in order for the student to pass the Master's examination. This document must include the information that the student has irreversibly failed the Master's examination. Upon request, the chairperson of the examination board will issue a document listing only the completed examinations and coursework and the respective grades.

### **§ 31 Examination certificate; final grade; diploma supplement**

- (1) Graduates are to receive a certificate on the passed Master's examination without delay, if possible within four weeks of the last evaluation. This examination certificate is to include the grades and credits for all module examinations, the topic of the Master's thesis, the grades and credits for the Master's thesis and the final oral examination, the final grade for the Master's examination and in case of transfer credits, the name of the institution where the examination was taken.
- (2) The final grade for the Master's examination is the average of the grades for the module examinations, the Master's thesis and the final oral examination, which have been weighted either by the corresponding credits or in another manner (defined in § 24 or the study plan). If a student has selected more than the required number of modules from the catalog of required electives and has passed them with a grade of at least "sufficient", only the grades of the modules the student determined as required electives at the time of admission to the examination will be considered for the calculation of the final grade.
- (3) In accordance with § 23 (2), grades for additional modules are not accounted for in the calculation of the final grade.
- (4) The examination certificate is signed by the chairperson of the examination board and bears the date of the day on which the last examination was taken.
- (5) Graduates are to receive their Master's certificate (*Masterurkunde*) along with the examination certificate. The Master's certificate bears the same date as the examination certificate. The Master's certificate certifies that the Master's degree has been awarded in compliance with § 2 (5).

- (6) The Master's certificate is signed by the dean of the respective faculty and by the chairperson of the examination board and bears the seal of Technische Hochschule Köln (University of Applied Sciences).
- (7) In addition to the Master's certificate and the examination certificate, graduates receive a diploma supplement in English, which corresponds to the guidelines and agreements of the German Rectors' Conference.

## **VI Final provisions**

### **§ 32 Inspection of examination papers**

After each attempt to pass a module examination or the Master's thesis and final oral examination, the student is to be given access (upon request) to the written or electronic examination concerned and – if available – the examiners' records related to the examination and the examination records of an oral examination. Access to a Master's thesis that was graded at least "sufficient" is to be granted only after the corresponding final oral examination (if applicable) was taken. Requests to access these documents are to be addressed to the chairperson of the examination board within one month of the announcement of the grade for the module examination or within one month of the delivery of the examination certificate or the certification on irreversibly failing the Master's examination. The chairperson determines time and place of the inspection.

### **§ 33 Invalidity of examinations**

- (1) If a student cheated during an examination and the cheating is detected only after the delivery of the examination certificate, the Master's certificate, diploma supplement or the certificate mentioned in § 30 (2) sentences 4 and 6, the examination board is entitled to subsequently amend the grades for those examinations during which the student cheated and to declare the Master's examination failed or partially failed.
- (2) If the requirements for admission to an examination were not met but the student did not attempt to cheat and if this matter was detected only after the examination certificate, Master's certificate, diploma supplement or the certification mentioned in § 30 (2) sentences 4 and 6 were issued, this shortcoming is offset by the student's passing of the examination. If the student deliberately effected a wrongful admission, the examination board decides on the legal consequences with due regard to the Administrative Procedures Act (*Verwaltungsverfahrensgesetz*) of North Rhine-Westphalia.
- (3) If necessary, the incorrect examination certificate, the Master's certificate and the diploma supplement or the incorrect document as per § 30 (2), sentences 4 and 6 are to be collected and reissued. A decision pursuant to subsections 1 and 2 is to be ruled out if five years or more have passed since the examination certificate or document as per § 30 (2) sentences 4 and 6 was issued.

### **§ 34 Entry into force; transitional regulations**

- (1) These examination regulations will come into force on September 1, 2020 and will be published in Technische Hochschule Köln's official communication (*Amtliche Mitteilungen*).

- (2) These examination regulations apply to all students who enroll in or apply for admission to the Master's program Automation & IT at Technische Hochschule Köln, Gummersbach Campus, as of the winter semester 2020/2021. Additionally, subsection 3 also applies to all students enrolled in the Master's program Automation & IT based on the examination regulations of January 23, 2015 (*Amtliche Mitteilung* 01/2015).
- (3) The current version of the examination regulations for the Master's program Automation & IT of the Faculty of Computer Science and Engineering Science at Technische Hochschule Köln dated January 23, 2015 (*Amtliche Mitteilung* 01/2015) will expire as of August 31, 2023 (for full-time studies) and as of August 31, 2024 (for part-time studies). Students of the program Automation & IT at Technische Hochschule Köln, Gummersbach Campus, who started their studies before the summer semester 2021, can complete their studies on the basis of the examination law valid before March 1, 2021 until the end of the summer semester 2023 (for full-time studies) or 2024 (for part-time studies).
- (4) The examination regulations are published on the basis of the resolution of the faculty council of the Faculty of Computer Science and Engineering Science at Technische Hochschule Köln of November 18, 2020 and after legal review by the Executive Board of Technische Hochschule Köln on December 16, 2020.

Cologne, January 7, 2021

President of Technische Hochschule Köln  
(University of Applied Sciences)

Prof. Dr. Stefan Herzig

**Annex:**

Annex 1: Study plan for full-time studies

Annex 2: Example study plan for part-time studies

Annex 3: Required documents for enrollment in the part-time program



## Annex 1: Study plan for full-time studies

Module	Submodule	Sem.	ECTS	Semester			
				1	2	3	4
				<b>ECTS</b>			
Industrial Communication and Information Security in Industrial Automation	Industrial Ethernet	1	12	3			
	Industrial IT and Industrial IoT	2			3		
	IT-Security - Management and Technologies	1		3			
	Industrial Security in Automation	2			3		
Integration of Technical and Business Information Systems	Object oriented Programming for Data Science	1	11	3			
	Relational Databases	1		2			
	Enterprise Resource Planning Systems	1		3			
	Industrial IoT and Manufacturing Execution Systems	2			3		
Modelling and Simulation of Technical Systems	Modelling and Simulation of Continuous Systems	2	14		4		
	Modelling and Simulation of Discrete Event Systems	2			3		
	Data-driven Modelling and Model Optimization	2			5		
	Modelling and Simulation of Electrical Energy Systems	1		2			
Control of Technical Systems	Digital Signal Processing and Optoelectronics	2	13		4		
	Linear, Nonlinear and Model Predictive Control	1		5			
	Automation of Discrete Event Systems	2		2			
	Protection Automation and Control in Electrical Energy Supply	2			2		
Optimization of Technical Systems	Numerical Methods	1	10	3			
	Optimization	1		4			
	Machine Learning and AI	2			3		
Case Studies	Case Study I	3	30			10	
	Case Study II	3				10	
	Case Study III	3				10	
Master's Thesis	Thesis	4	30				20
	Final oral examination	4					10
<b>Total ECTS</b>			<b>120</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>

## Annex 2: Example study plan for part-time studies

Module	Submodule	Sem.	ECTS	ECTS/ Semester					
				1	2	3	4	5	6
				<b>ECTS</b>					
Industrial Communication and Information Security in Industrial Automation	Industrial Ethernet	1	12	3					
	Industrial IT and Industrial IoT	2			3				
	IT-Security - Management and Technologies	1				3			
	Industrial Security in Automation	2					3		
Integration of Technical and Business Information Systems	Object oriented Programming for Data Science	1	11	3					
	Relational Databases	1		2					
	Enterprise Resource Planning Systems	1				3			
	Industrial IoT and Manufacturing Execution Systems	2					3		
Modelling and Simulation of Technical Systems	Modelling and Simulation of Continuous Systems	2	14		4				
	Modelling and Simulation of Discrete Event Systems	2			3				
	Data-driven Modelling and Model Optimization	2					5		
	Modelling and Simulation of Electrical Energy Systems	1		2					
Control of Technical Systems	Digital Signal Processing and Optoelectronics	2	13		4				
	Linear, Nonlinear and Model Predictive Control	1		5					
	Automation of Discrete Event Systems	2				2			
	Protection Automation and Control in Electrical Energy Supply	2			2				
Optimization of Technical Systems	Numerical Methods	1	10	3					
	Optimization	1				4			
	Machine Learning and AI	2					3		
Case Studies	Case Study I	3	30			10			
	Case Study II	3						10	
	Case Study III	3							10
Master's Thesis	Thesis	4	30						20
	Final oral examination	4							
<b>Total ECTS</b>			<b>120</b>	<b>18</b>	<b>16</b>	<b>22</b>	<b>14</b>	<b>20</b>	<b>30</b>

### **Annex 3: Required documents for enrollment in the part-time program**

#### **a) Care for own children**

- Child(ren)'s birth certificate(s)
- Registration certificate (*Meldebesccheinigung*) or confirmation issued by the registration office that applicant and child(ren) live in the same household (*Haushaltsbescheinigung*)
- Custody declaration (for fathers not married to the mother of the child(ren)) or marriage certificate

#### **b) Care for close relatives (parents, grandparents, children or spouse)**

- Medical certificate issued by the attending doctor

#### **c) Own severe illness or disability**

- Disability card (for persons with a degree of disability of 50% or more) or
- Specialist medical report confirming a disability or chronic disease. The report must be comprehensible for non-experts in medical matters.

#### **d) Employment (at least 50% of a full-time position)**

- Work contract / vocational training contract

#### **e) Professional athlete**

- Confirmation issued by the respective sports club

#### **f) Other social reasons**

- Corresponding proof