

Naturwissenschaftlich-Technische Fakultät
Department Maschinenbau
Lehrstuhl für Fertigungsautomatisierung und Montage
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Introduction to scientific writing:

**Guidelines for the preparation of
student projects (Studienarbeiten) and master theses**

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1 Student Project („Studienarbeit“) and Master Thesis

In the master's degree program in mechatronics, a student project („Studienarbeit“) and the final thesis are among the study achievements that require a high degree of independence. Furthermore these theses serve to acquire the ability to work scientifically. Often, the „Studienarbeit“ or the thesis is the first comprehensive scientific work within the study program.

The core competency that this kind of coursework is about is how to approach gaining scientific insights. This does not mean that no practically relevant problems can be dealt with. Rather, when designing and implementing the work, it is important to ensure that a systematic approach based on existing findings is selected as well as that the proceeding is scientifically methodically correct and appropriately documented.

2 Preconditions for Supervision

At the beginning of a “Studienarbeit” and the final thesis, there usually is a (provisional) task description, which is issued by the chair or proposed by the student himself. A template of the preliminary task is attached, see **APPENDIX A**. If the task contains experimental work to be carried out in the laboratory, an access authorization for the laboratory must be obtained.

Note: The preliminary task must be transferred to a definitive task at a given time in order to include this in the bound work.

As a prerequisite for the supervision of a „Studienarbeit“ or thesis by the chair, three documents must be submitted:

- an **exposé** that refers to the task,
- a preliminary **structure** of the chosen topic as well as
- a **personnel questionnaire**.

By submitting these documents, the student should prove that he / she has given sufficient thought to the problem posed. This means that he / she has mentally anticipated the processing of the entire task to the required depth and made the necessary decisions regarding the methods and procedures. The submitted documents set the binding framework, within which the student can demonstrate by means of a defined task (in a given time) that he / she is able to independently apply scientific methods and findings.

The following aspects should be taken into account when preparing the above mentioned documents.

2.1 Exposé

First a **definition of the problem** to be dealt with must be made within the framework of the exposé. This includes, in addition to the content and thematic delimitation of the relevant area, the clear and unambiguous specification of the task, if possible with the naming of subtasks. Furthermore, it should be clear from the synopsis, which are the **goals of the work** and which result the work should provide. The third, essential content of the exposé is the description of the **methods** with which the set goals are to be achieved. In principle, the choice of method should be justified. It should be shown why the chosen method seems to be suitable for attaining the objective. If several alternative methods are available, it is necessary to explain why the decision was made in favor of the chosen method.

On the one hand, the preparation of an exposé requires a comprehensive mental discussion of the topic and a mental anticipation of all work steps to be carried out in the later stages (preparation before the application is registered). On the other hand, the wording of the exposé should be concise, so that the scope does not exceed two pages. As a result, a basic structure of the solution (red thread) is obtained, which systematically fulfills the task for the student. Furthermore, the exposé serves to avoid misunderstandings (e.g. a different interpretation of the task) by specifying and narrowing down the content of the work.

In the following, the three central aspects of an exposé are explained.

Problem

The central content of the problem is the complete spatial, functional and content definition of the work's scope. This includes the description of the initial situation as well as the clear determination of the content of the task. This also includes the exclusion of irrelevant aspects.

Objective

The aim is not to present the concrete results of the work, as this is often not possible before the work is done. Rather, it is about the fundamental answer to the question of which knowledge increase should result from the work. Thus, the objective relates directly to the problem described above.

Methods

First of all, it has to be explained which methods are available for solving a specific problem. These are then to be compared with one another and it is necessary to explain why the chosen method (s) appear / seem suitable for attaining the objective. It also has to be explained why other methods were not chosen.

Length and delivery:

The Exposé should not exceed two pages. It is the task of the student to distinguish between important and unimportant information. The relevant information must be condensed so that both the content and the formal requirements of the exposé are met.

In the case of final theses, the exposé must be sent to both supervisors by e-mail as a PDF file. Since the synopsis is usually discussed and revised several times before registration in the examination office (Prüfungsamt), it is also important to ensure that the supervisors have got the current version of the exposé before an appointment (at least 2 working days before). A template for the exposé is attached as **APPENDIX B** to this guide. The file name should contain the date of creation as well as the name and be structured as follows:

Example: 2017-11-25_family name_given name_expose.pdf

2.2 Structure

The (provisional) outline, in combination with the exposé, constitutes the "roadmap" for further processing. The approach described in the exposé must therefore also be reflected in the structure. At a glance, the reader should be able to see the procedure used to create the work.

From the outline, the logical structure of the work and the consistency of the thought process should be recognizable. If the procedure during the course of the work deviates from the defined ideas in the exposé and the outline, this has to be agreed with the supervisors.

The name of the file for the structure should be in the following form:

Example: 2017-11-25_family name_given name_Structure.pdf

2.3 Personal Questionnaire

The personal questionnaire is used to record the contact details of the student and the supervisor in the company (if available). The corresponding form is available in the secretariat of the chair (**APPENDIX C**) and is also available as a Word file. After com-

pleting the form, the form must be saved in a PDF file or scanned as a PDF file if it has been completed by hand.

The naming of the file takes place in the following form:

Example: 2017-11-25_family name_given name_Personal Data.pdf

3 Guidelines for formal design

This guideline is intended to provide orientation for the formally correct design of academic papers ("Studienarbeit" and master thesis).

3.1 General requirement

The work should be bound and submitted with a firm cover (no spiral binding) up to the time specified by the examination office. For the printout white A4 sheets (copy paper) are to be used, whereby the printing can be one-sided or (for reasons of environmental protection) preferably on both sides.

The text body should be created with the font Arial (or similar) in font size of 11 pt and with 1.5-line spacing. Minimum font size (e.g. in tables and figures) may not be less than 9 pt.

The following minimum dimensions regarding the margins must be observed:

upper and lower edge: 25 mm, left and right edge: 30 mm.

The page number is at a distance of at least one blank line centered above or below the text block.

3.2 Overall structure of the work

Like any scientific work, a "Studienarbeit" or a thesis consist of a section of text that is continuously provided with page numbers. The text section is preceded by such pages as the title page, the (final) task description (by the chair), a foreword (if desired), the abstract and the table of contents. A list of abbreviations (if required) as well as the figures and table directories (if desired) comes before the table of contents. These upstream pages are separately provided with page numbers, Roman numerals are customary for this. The bibliography is placed at the end of the text section, with the page count being continued from the text section. Any attachments arranged after the text section will be provided with page numbers separately.

As an aid, the overall structure with a typical structure for a thesis in engineering is giv-

en here. Since the (final) structure must reflect the content-related aspects of (special) work, the structure presented here can not, of course, be understood as a general pattern. The chapter headings have to be adapted to the respective requirements of the work.

Typical structure for a thesis in engineering
Title page (see APPENDIX E)
Registration sheet (s. ANNEX D) by the examination office
Task description (see APPENDIX A)
I. Preface
II. Abstract
III. Table of Contents
IV. List of Figures / List of Tables
V. List of Abbreviations
1. Introduction / motivation
2. Objectives
3. State of the art and research
4. Method / Procedure
5. Test Procedure
6. Results of the analysis
7. Discussion / Interpretation
8. Summary
9. Outlook
10. References
11. Annexes / Appendices
Declaration of independence (s. APPENDIX F)

Obviously the structure of the work that has been set up at the beginning of the work can or should change in the course of the processing time. Accordingly, the final table of contents of the written paper should be finalized at a later stage of the paper.

For the structuring of the main chapters in subchapters, the decadal structuring and numbering" (according to DIN 1422) should be applied.

The headings should be formulated easy to understand and as short and precise as possible. Each title requires a concrete reference to the content and describes the following chapter as meaningfully as possible ("talking headline"). Subject-specific abbreviations

viations should be avoided in chapter headings in order to ensure general comprehensibility. Each subitem must be part of the parent outline points and must fully describe the parent term. The order of the subitems should be based on a recognizable and meaningful criterion.

The title page, the registration form of the examination office, the task description, the abstract as well as a summary and the literature list are indispensable for each thesis. The registration form by the examination office alone is not required for a "Studienarbeit" alone. The title page (also called cover page) is to be used as template for the chair (s. **APPENDIX E**), which is available as a Word file.

3.3 *Special directories and chapters*

A **list of abbreviations** is always required if abbreviations that are in need of explanation are used in the text. As a service to the reader of a paper, it is recommended to give an abbreviation for the first time in the text the exact plain text. Example: "The light output of a LED (Light Emitting Diode) is significantly greater than ...". In chapter headings abbreviations should generally be avoided. Commonly known abbreviations such as "e.g., i.e., approx., etc." or well-known acronyms such as EU and USA need not be listed in the abbreviation list.

If equations are used in a text on several pages, a **list of equation symbols** with clear names for the sizes and units should be compiled. Such a directory must be inserted after the list of abbreviations. If equations are provided on one page only, the explanation can also be done on this page.

An **abstract** is a particularly compact summary of the entire work in a maximum of 300 words. The abstract should be inserted before the table of contents.

In addition, there should always be a summary of the work to be placed at the end of the text section. The abstract should not develop new ideas that are not already mentioned in the main body of work. Rather, answers to the following questions should be formulated:

- What was the task or problem?
- What was done, examined or developed? (Call special features!)
- What is the result of the work?

The section "**State of the art**" should not be a summary of textbook material. Rather, it should delineate the topic, provide an overview of relevant directions in research and

teaching and put the study or final thesis in the context of existing scientific work. Ideally, the knowledge gap that is going to be closed by the work should be recognizable.

In addition to the outlook, a chapter "Discussion / Interpretation" is the only section in which the author may contribute subjective opinions. The first chapter serves to understand and interpret the results of the investigation. It should be done self-critically, without detracting from their own performance. Discussions on areas of outcome validity should also be included here.

3.4 Placement and numbering of figures and tables

Inserting of figures and tables in the text is not a problem in today's word processing environment any more. Therefore, it is generally accepted that figures and tables should be inserted in the current text (in a well-readable size) wherever they are be addressed for the first time. Exceptions are large images or tables that exceed the size of a text page.

Figures and tables are provided with numbers and titles, all figures for themselves and all tables for themselves. Picture numbers or table numbers are assigned either continuously (for example, Fig. 17, Fig. 18, ...) or section by section (e.g., Fig. 3.14, Fig. 4.1, ...). Every image and every table in the work must be addressed at least once in the text.

For a figure (such as a photo, a thumbnail, a chart, or a drawing), the title is below the location for the image, with the title formulated as accurately as possible. If the image was not created by the student, the source is named just after the title. When illustrations and tables are reproduced in a modified form, the original source is referenced by the words "based on" (e.g., "Source: based on Popper (2009)").

Example of the arrangement of a figure with title and source:

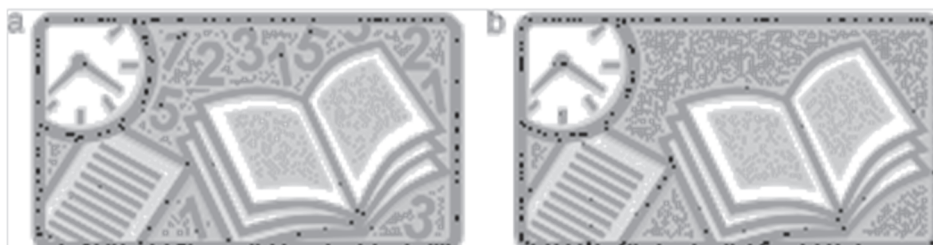


Figure 3.12: Objects examined, a) with numbers, b) without numbers

(Source: Institute for Research ...)

For a table, the title should be above the place for this table. Again, if the content

comes from third-party authors, the source have to be listed immediately on the table (preferably under the title).

Example of the arrangement of a table with title and source:

Table 2.3: Quantities of produced products

Source: Statistical Yearbook of the German Association for ..., Edition 2010

<i>Year</i>	<i>Product</i>	<i>Quantity</i>
1980	A-4711	2.100.070
1990	N-8566-neo	234.567

Numerical values in table columns have to be in the correct position among each other. This is especially important for currency numbers or other sizes with decimal places.

For tables that are printed on multiple pages, each subtable (on an individual page must have a title bar. Example: Table 17 (part 1 of 3): "Title", if the table goes over three pages.

Note: A good orientation for the integration of figures and tables generally provides the manner in which books of well-known publishers (such as Addison Wesley, McGraw-Hill or Springer) happens. Although there are a range of variants, such reference books are designed predominantly according to relevant standards and aim at good readability. Once a variant has been selected, it must be consistently applied in one work.

4 Citation and source list

In scientific works, all sources used must be identified as foreign ideas. The traceability of each quote is an expression of scientific diligence. Each reader must be enabled by the information in order to be able to form their own image of the source and its interpretation.

As a rule, verbatim quotations must be used sparingly (in technical elaborations). Quotations should focus on the sections "Introduction" and "State of Research and Technology". Quotations in other sections should always be well motivated.

Literal citations should be short and should not be used to replace your own formulations. Longer citations are only appropriate if the wording chosen in the citation has a special significance for the overall context. In this case, it is advisable to indent the text and set it to one line spacing. The form of the references in the text to the bibliography and the form of references in the bibliography must follow a standard and comply with it, see section 4.3.

4.1 Direct Quote

Direct (literal) citations are literal copies of passages of text and are started and terminated by quotation marks. If there are highlights in the original, these should also be shown in the quote. Any deviation from the original must be clearly marked. Usually, the following notation is used:

- Omission of words or sentences or grammatical changes caused by the own sentence structure by three points [...]
- Own note to explain a word or factual circumstance used in the quotation by adding [Note of the author.]

4.2 Indirect Quote

An indirect, analogous quote exists in the case of a copy that deviates in wording from a passage or a thought of another author. The scope of a meaningful acquisition must be clearly recognizable. It may be necessary to preface the quotation with an introductory phrase that clearly distinguishes the foreign thoughts from their own contents. The source reference for indirect quotations begins with "cf." which is an abbreviation of the Latin word *confer* and it means to compare.

4.3 Source list or bibliography

As a general rule, all sources mentioned in the text, including the sources mentioned in the illustrations and tables, should be mentioned in a list of sources or bibliographies. Conversely, this means that only those sources are included in the list, which are also cited in the text.

The sources include both printed publications (eg books or monographs, conference proceedings, periodicals and company publications) as well as Internet sites (online sources), but also unpublished sources (eg research reports, company-internal sources) Reports and if necessary also oral statements). It may be useful to create separate directories for printed publications and for online sources.

In a source or bibliography, the individual sources are listed in alphabetical order of the names of the (main) authors.

With a small number of sources (for example, less than 10), it is conceivable to create citations in the text and the source directory manually. Today, one should use the corresponding functions of a word processing system, for example MS Word or LaTeX.

There are several standards for the formal structure of a bibliography. In the technical

literature, the form according to ISO 690 or the form of the Harvard notation, is predominantly used.

The citation method according to the Harvard notation is increasingly used because of the greater flexibility in the technical literature and is also recommended for use here. The names of the authors can also be shortened consistently to three or four letters for the citation number. The sources in the bibliography are generally named in alphabetical order.

Citations from Internet sources

Online publications are sometimes cited, despite some differences in the verifiability of printed publications. Since most Internet sources are subject to no control process and they can change at any time, other forms of publication are preferable if possible. Citations from the Internet are also to be distinguished in terms of their credibility. For instance, online catalogs of manufacturers of machine components are usually allowed, anonymous participation platforms such as Wikipedia or social networks are usually not.

If one uses Internet sources, this must be stated with the explicit reference "Online" and the date of the call must be noted. The citation methods are based on ISO 690-2 and ISO 8601. (A date in the following format is recommended: <year>-<month>-<day>)

General scheme:

'Usual citation'

Online in Internet: URL [Status Date of Inquiry]

Examples of sources where authors and / or titles of a contribution are identifiable:

- [1] Bleuel, Jens: Citation of Internet sources
Online in Internet: URL: <http://www.bleuel.com/ip-zit.pdf> [as of 2010-11-30]
- [2] Cornell Law School: The Legal Information Institute. Supreme Court Collection.
Online in Internet: URL: <http://supct.law.cornell.edu/supct/> [as of 2000-03-11]

Examples of sources for which no author and no title of a contribution are identifiable:

- [3] Delivery program of the company Lilotronik
Online in Internet: URL: <http://www.lilotronik.de/lieferprogramm.htm> [as of 2010-11-30]
- [4] Technology Lexicon of the company BMW AG
Online in Internet: URL: <http://www.bmw.de/lexikon/index.htm> [as of 2016-11-30]

For online peer-reviewed journal articles and books, include the volume number and

pages and use the DOI (Digital Object Identifier) instead of the URL if the DOI available. DOI links are more stable than URLs, which change frequently. An example would look something like this:

Johnson, T. (2014). Sleep deprivation and learning. *Sleep Science Journal*. 29, 500-505. DOI: 10.1006/ssj.2014

5 Submission

A Master's thesis is to be submitted to the examination office in time with one copy in bound form. As a rule, the two examiners each receive one additional copy. The need for further copies is to be inquired by the student, especially in the case of works created in connection with a company.

A „Studienarbeit“ is not given to the examination office, but only to the supervisors. So there are two copies to submit. The chair will issue a performance certificate after (completed) evaluation, which will go to the examination office.

The work must be submitted additionally as a PDF file either by e-mail or on a data carrier, whereby it must be ensured that an archivable PDF/A-compliant document is generated. When converting a previously created WORD file into a PDF file, it must be: For example, the option "PDF / A-1b: 2005 (RGB) standard" can be set.

The PDF document (if any) should be accompanied by additional files to document the work. This includes in any case used software implementations as well as raw results data in experimental work.

6 Tips for writing scientific papers

For the writing of scientific papers in the technical field, the word processing program **Microsoft Office Word** or the program **LaTeX** are predominantly used. (Note: other text processing programs can be used as well.) In general, the time spent writing and using a word processor should not be underestimated. If experiences have not been gathered in a different context already, the familiarization with the functions of the word processing system should be done prior to the actual content-related work on the topic of a „Studienarbeit“ or master thesis.

While manual formatting with relatively little effort is possible when writing seminar papers on a small scale, manual formatting of large scale scientific papers is not recommended due to time and error. If - for example - numbering of outline points, figures and tables is done manually, all subsequent elements of the same type must be

changed manually when adding additional elements later. In addition, the corresponding directories must be adapted. Therefore, the use of format templates and automatic directories makes sense.

To manage the literature either a special software program can be used, for example **Citavi** which is provided as a full version for free by the Library of University of Siegen or one can use the corresponding reference functions of the text processing program. In all cases, the use should be practiced in advance.

Before printing and binding, the work should be read by one or more persons. This applies not only with regard to formal criteria, but also with regard to the content, in particular the traceability and reasonableness. The work should be comprehensible and logical for a reader who does not have the knowledge of the author. This may be assumed a basic technical knowledge.

Note: Proofreading does not mean that the person who reads the correction makes changes of a substantive nature or even adds new content. In this case, it is foreign ideas that must be identified accordingly.

7 Plagiarism

The plagiarism describes "the unlawful appropriation of thoughts, ideas or the like of another in the artistic or scientific field and their publication". Such a process is not a trivial offense, which is why all written work (including colloquium contributions) can be checked for correct citation. By submitting a written statement, the student agrees that the work will be checked with appropriate software. If a plagiarism is detected, the consequence of the severity of the offense depends and can lead from downgrading the grade to the failure of the work (including notification to the Examination Office).

Plagiarism is a common (and often misunderstood) problem that is often the result of a lack of knowledge and skills. See more about Plagiarism at this URL: <http://www.plagiarism.org/>.

8 Recommended literature

Holtom, D. & F. E., 2003. *Enjoy writing Your Science Thesis or Dissertation*.
London: Imperial College Press.

Bachelorarbeit im Studiengang <Maschinenbau>

für <Vorname> <Name> , Matrikel-Nr.: <1234567>

Thema:

<Thema der Arbeit>

Aufgabenbeschreibung:

ANLAGE A

**Muster für die
Aufgabenstellung einer Bachelorarbeit**

Dieses Dokument wird vom Lehrstuhl
ausgegeben.

Für eine Studienarbeit und für eine
Masterarbeit existieren entsprechende
Dokumente.

Betreuer: Univ.-Prof. Dr.-Ing. Martin Manns
Dipl.-Ing. Emil Mitarbeiter

Bearbeiter:	Betreuer:	Zugang zum Labor erteilt:

Name:	Vorname:	
Matrikel-Nummer:		Datum:
E-Mail-Adresse:		

Exposé zur Studienarbeit / Bachelorarbeit / Masterarbeit im Studiengang: (Nichtzutreffendes durchstreichen)
Thema der Arbeit:

ANLAGE B

Muster für das Exposé einer Studien-, Bachelor- oder Masterarbeit

Das Exposé soll folgende Fragen beantworten:

- Welches Thema behandelt die Arbeit?
- Warum ist die Bearbeitung dieses Themas von Relevanz?
- Welche Aspekte sind Gegenstand der Arbeit? Welche nicht?
- Welche Ziele werden mit der Arbeit verfolgt bzw. erreicht werden?
- Wie sollen die genannten Ziele erreicht werden?
- Welche Methoden kommen für die Bearbeitung der Problemstellung in Frage?
- Welche Methode(n) sollen eingesetzt werden?
- Warum wird (werden) diese Methode(n) eingesetzt bzw. andere Methoden nicht?

Der Dateiname des Exposés ist nach folgendem Muster zu benennen:

<Datum der Erstellung>_<Nachname_Vorname>Expose.pdf

Personalfragebogen

Name:	Vorname:	
Studiengang:	Semester:	Matrikel-Nr.:
E-Mail-Adresse:	Telefonnummer:	

Art der Arbeit: Studienarbeit / Bachelorarbeit / Masterarbeit (zutreffendes unterstreichen)

Thema:

Betreuer:

Beteiligtes Unternehmen:

Unternehmen:	
Name des Betreuers:	Funktion:

ANLAGE C

Muster für den Personalfragebogen

Dieses Dokument wird vom Lehrstuhl ausgegeben.

	sehr gut	gut	Grundk.	keine
Softwarekenntnisse				
CATIA V5				
NX				
CREO				
Solidworks				
Programmierkenntnisse				
Matlab				
C/C++				
Fortran				
Python				
Java				
SPS- bzw. Roboterprogrammierung				
Step7				
IEC 6-1131				
KUKA				
ABB-Studio				
ROS				

Sonstige Vorkenntnisse:
Tätigkeit als studentische Hilfskraft:
Lehrstuhl:
von
bis
Duales Studium: O ja O nein)
Unternehmen:

Datum:	Unterschrift:
--------	---------------

Bachelorarbeit

im Studiengang Wirtschaftsingenieurwesen

Vorname Nachname

geboren am 13.07.1993
in Olpe
Matrikelnummer: 1078244

Thema der Arbeit

ANLAGE D

Muster für das Anmeldeblatt einer Bachelorarbeit

Dieses Dokument wird vom Prüfungsamt
nach Anmeldung der Arbeit ausgegeben.

Für eine Masterarbeit existiert ein
entsprechendes Dokument.

Betreuender Hochschullehrer: Univ.-Prof. Dr.-Ing. Peter Scharf

1. Prüfer: Univ.-Prof. Dr.-Ing. Peter Scharf
2. Prüfer: Univ.-Prof. Dr.-Ing. Martin Manns

Tag der Ausgabe: 31.05.2017
Tag der Abgabe: 30.09.2017

Siegen, den 31.05.2017

Der Vorsitzende des
Prüfungsausschusses
Wirtschaftsingenieurwesen

Unterschrift des Vorsitzenden

Naturwissenschaftlich-Technische Fakultät
Department Maschinenbau
Fertigungsautomatisierung und Montage
Univ.-Prof. Dr.-Ing. Martin Manns

ANLAGE E

**Muster für das
Titelblatt einer Bachelorarbeit**

**Thema der Arbeit - Thema der Arbeit -
Thema der Arbeit**

<Bachelorarbeit>

im Studiengang <Maschinenbau>

von

Maximilian Mustermann

Matrikel-Nr. 1234567

Alternativ:
Studienarbeit oder
Masterarbeit

Alternativ
zutreffenden Studien-
gang nennen.

Betreuer:

Univ.-Prof. Dr.-Ing. Martin Manns
Dipl.-Ing. Emil Mitarbeiter

Monat und Jahr der
Abgabe

Oktober 2017

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ANLAGE F

Muster für eine Selbstständigkeitserklärung

Selbstständigkeitserklärung

Hiermit bestätige ich, dass ich die vorliegende Arbeit selbstständig verfasst und keine anderen als die angegebenen Hilfsmittel benutzt habe. Die Stellen der Arbeit, die dem Wortlaut oder dem Sinn nach anderen Werken (dazu zählen auch Internetquellen) entnommen sind, wurden unter Angabe der Quelle kenntlich gemacht.

Diejenigen Paragraphen, der für mich gültigen Prüfungsordnung, welche etwaige Betrugsversuche betreffen, habe ich zur Kenntnis genommen.

Ort, Datum

Original-Unterschrift