UNIVERSITÄT
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ESSEN

*Offen im Denken*

# Thesis Guide

Faculty for Engineering

Department for Electrical Engineering and

Information Technology

**Institute Medical Technology Systems**

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# 1 Content design

The structure of the content depends very much on the type of work and the topic itself. At this point, therefore, only a rough guideline can be given for the basic organisation of the content. Basically, it should be mentioned that development work must be described in four phases: requirements study, analysis, design and, if necessary, implementation. These are sensibly distributed among the basic elements of the text of the work. Detailed descriptions of the implementation should only appear in the text if they are of real importance to the paper - in case of doubt they rather belong in the appendix. Apart from short sections, the source code of a software should not appear on paper at all (not even in the appendix!) but should be available on an enclosed data medium. If tests are planned as part of the work, a distinction must be made between tests with and without test persons. In the case of testing with test subjects, an ethics vote must be obtained before the experiment begins.

## 1.1 Length of the thesis

The length of the thesis can be found in the current examination regulations (Prüfungsordnung) for your course. The number of pages given refers to the pure text, whereby indexes and the appendix are NOT counted.

## 1.2 Basic principles for the outline

The rough outline should be determined before the actual writing work begins. This ensures that the text has a common thread and writing is usually easier. In addition, the basic working method can be checked, and all areas are worked through.
The outline should be checked regularly by the supervisor to prevent major mistakes.
The following list of basic principles should be reviewed regularly during the writing process:

- Headings summarise subheadings
- Subheadings are homogeneous to each other
- Order is logical (no mental leaps)
- No “lonely” subheadings (e.g., chapters with only one subchapter)
- Uniform language level
- No too deeply nested structure → maximum 4 levels of structure
- A heading is followed by text and not immediately by a subheading

## 1.3 Content structure

In general, a thesis should contain the following parts, whereby a part does not necessarily correspond to a chapter:

- Introduction
- Theory part / state of the art
- Justification and description of the planned work and experiments (if present)
- Methods and material used
- Results and Evaluation
- Summary and conclusion

### 1.3.1 Introduction

The introduction introduces the topic of the thesis. To this, it specifies the research question and states the aim of the study/work. It also introduces the context of the question and provides information about the technical scientific relevance of the topic. The introduction should be written in such a way that readers who are not familiar with the topic can understand the question and the problem. Nevertheless, the introduction should be short and concise.

### 1.3.2 Theory part / state of the art

In the theory section, existing approaches and scientific contributions to the problem are examined. In addition, the underlying theoretical foundations are presented. For this purpose, existing approaches, procedures, and ideas will be explained, compared, and evaluated.
If the whole thesis follows a working method explicitly formulated in the literature, this should also be explained (briefly) - the extent depends on the general level of familiarity with the working method. The better known, the shorter an area can be described. It is important to make an obvious reference to specialist literature!

### 1.3.4 Justification and description of the planned work and experiments (if present)

Here, the original question is dealt with by referring to the theory presented in the previous part. It should be described what the own contribution consists of and how the question was dealt with. In addition, the procedure should be thoroughly justified.
The structure of this chapter depends on the type of thesis (the contents mentioned here are only suggestions!).
In the case of thesis that deal with a question through practical investigations (e.g., measurements on the developed hardware, data collection from test persons for subsequent examination), the structure of these investigations must also be explained. This can be roughly divided into two different categories of experiments:

**Study with subject participation**
This can be pure data acquisition, whereby the data is required to carry out a comprehensive evaluation. It can also be a test of developed hardware or software with test persons.
Here, too, as described in the previous section, the test setup and execution must be described in detail and documented with pictures. This means that it must be explained which experiments (paradigms) and procedures were used, how the experimental setup was implemented and why this was chosen.
It should also be noted that the study must be approved by an application to the ethics committee (see also chapter 1.3.3). Therefore, it should already be mentioned at this point that the study has been approved by the ethics committee and that all subjects have been informed and have signed a declaration of consent (e.g.: "The study was conducted in accordance with the Declaration of Helsinki and approved in writing by the Ethics Committee xxx of the UDE. The subjects have been informed and have signed a written consent to participate in the study."). The ethics application is either already available or must be submitted to the responsible ethics committee as part of the final thesis before the studies with subjects begin. The supervisor of the thesis,

who is familiar with the procedure, provides support here. In addition, all participants in the study must sign both a consent form for the trial and a data protection declaration. This must (!!!) also be explained in a separate subchapter of the written thesis. If pictures are used in the written elaboration in which subjects can be seen, an additional data protection declaration of the person to be seen is required!
After these treatments, a hypothesis must be clearly stated in a separate paragraph, which will be validated or falsified with the experiments. The aim is generally falsification, which is why it is helpful to set up a hypothesis that can be refuted, e.g., "walking and running require the same amount of energy" - here it can then be shown with measurements of, e.g., the breathing rate and increase in body temperature, that this is not the case. However, the hypothesis must not be nonsensical (as in the chosen example) but must refer to previous work, for example, where it is suspected that the results are not correct, or their interpretation is not correct. Based on a good hypothesis, it is then easy to design a statistical investigation of the results to refute the hypothesis.

The following information are important:

- Experimental design and procedure
    - Why were these studies conducted? (Testing of the developed hardware or (pure) answering of a specific question or both?)
    - General justification of the approach and the experimental setup
    - If answering a specific question: Which paradigms were used and how were they modified (illustrations are helpful!)?
    - Reference to ethics vote
- Hypotheses
    - What are the basic assumptions that are falsified by the experiments?

**Hard- and software development**
In this case, the hardware or software to be developed is described and what the differences are from the previous state (if present) or why this (new) development seems necessary. It should also describe how the developed hardware or software will be tested to prove that it delivers the expected results. If this data collection or testing is done without the active participation of people, no ethics vote needs to be obtained! Nevertheless, the testing of the function must be explained in detail here.
It should be made clear what the experimental setup for the test looks like and how it came about. This is best argued with the help of pictures. In addition, the experimental procedure should be described in detail so that the reader could repeat the experiment in the same way. This also includes a description of what equipment was used, what amperage or what sampling rate was used, if this helps to understand the experimental setup or the intended development. Again, it may be helpful to make a hypothesis that can be statistically falsified to validate the functionality.

The following information are important:

- General hardware and software design
    - Does the software or hardware represent a further development? What does it consist of? Has it been newly developed? According to what criteria? How were the criteria identified?
        - Hardware to be developed
            - Theoretical approach (concept to addresses various theoretical possibilities)

        - Planned practical implementation (basic selection of components cannot be used pragmatically – in theory more is often possible than can be implemented in the final thesis)
    - Software to be developed
        - Theoretical approach (concept that addresses various theoretical possibilities)
        - Planned practical implementation (e.g., for which operating system, for which hardware etc. pragmatically usable – in theory more is often possible than can be implemented in the final thesis)
- How should the functionality be tested?
    - Description of the test for verification
    - It should be made clear what the aim of the investigation is in detail and what the possible results look like. However, no evaluation of the results is made here yet.
    - (If the functionality is tested with persons, see the previous section!)
- Hypotheses (if useful)
    - What are the basic assumptions that will be falsified with the experiments?

### 1.3.3 Methods and material used

When describing the methods and material used, a distinction must again be made as to whether, for example, the focus of the work was on the development of software and hardware or whether a specific question was investigated by means of a test person study.

**Study with subject participation**
If a pure study with test persons is carried out in the work, specific information on the methods must be provided here. This includes:

- Which devices were used? (e.g., actiCap 64 electrode system from MES, Germany)
- Which data (e.g., EEG) were collected and how:
    - E.g., 64 channels with wet electrodes and bandpass-filtered between 0 and 10 Hz according to an extended 10-20 system
    - Each type of data collected is described separately
- Which evaluations were carried out:
    - E.g., Is the analysis of the behavioural data described? Methods used or deviate from are also described in detail here.
    - For each data set, the analysis carried out is described separately
    - Possibly certain analyses of a data set are carried out so that other data can be evaluated in the first place. This must be described in a comprehensible way.
    - A joint evaluation of the data is also possible and is presented here accordingly, if necessary.
    - Statistics also belong to the evaluations. Here it is described how which data (separately or together) are statistically evaluated. This includes describing the statistical model, if applicable. Two examples are given:

- *To examine the topography of expected parietal positivity for each task, and furthermore to find out how the two different tasks (simple task and dual task) affect expected parietal positivity, the average amplitude values across subjects were analysed by repeated measures ANOVA, adjusting for stimulus type (standards, targets, deviations), time window (early: 350 ms-600 ms vs. late: 600 ms-850 ms) were considered as within-subjects factors [SPSS, version 20, SPSS Inc. late: 600 ms-850 ms), electrode (CPz, Pz, POz) and task (single task and double task) as within-subjects factors [SPSS, version 20, SPSS Inc, Chicago, IL, USA]. If necessary, a Greenhouse-Geisser correction was applied. For pairwise comparisons, the Bonferroni correction was applied.*
- *To assess reaction time to the target stimuli, the median reaction time for each subject was estimated based on the buzzer events. Note that the median reaction time had to be calculated because the reaction times within a subject were not normally distributed. The median value for each subject was averaged across all subjects for each task, and the difference between tasks was tested using a paired t-test.*

**Hard- and software development**

If hardware or software is developed as part of the thesis, the methods and the material used are described in this part. For the development of hardware, for example, it is explained exactly which components (also from which company) were used. For software development, the development environments used are also named and important libraries are referenced.

In addition, this part also describes and justifies which approaches were adopted. The concrete modifications or new development of a solution approach are also justified. The actual practical procedure, which can justifiably deviate from the planned one, is described (not too detailed).

If necessary, a validation with tests follows. For this, it must now be specified how these were carried out, e.g., number of tests, with or without test persons, how many test persons took part in the tests. Were all tests carried out on one day, if not, were there reasons to spread them out. Sketches of the test procedure with, e.g., times, subdivision of the sections of the tests often help!

In addition, it should be explained how the data (measurement data from the test of the software and hardware without test person participation or data from the test with test persons) were analysed (e.g., with the help of the t-test, RMSE, mean value, ANOVA (for more complex statistics)) and which corrections were necessary where (see examples before).

The following information are necessary:

- Components of the hardware and/or software, under
  - Reference to adopted code sections (citations are also essential here, as code can also be plagiarized) and
  - Indication of the use of specific development environments including libraries and prefabricated functions (if available)
- Functionality test
  - Number and type of tests and test subjects

- Description of the recorded measurement data
- Explanation of the evaluation of the data (statistics, if applicable)

### 1.3.5 Results and discussion

In this part, the results of the work are documented. This includes hardware and/or software development:

- Images of the finished prototype
- Illustrations of the user interface, if applicable with a description of the possible uses, but never of the entire source code

In experiments with and without test persons, either for testing the software or hardware or in test person studies, the results are not only described systematically in the text, but the individual results are clearly presented in tables and graphs. The aim here is not to present the individual measured value (unless this makes sense in exceptional cases or is important for the result), but to choose suitable presentation options, such as average values and scatter per test person and/or test under certain conditions, etc. If necessary, the statistical data should also be presented here. If necessary, the statistical significance should also be indicated here. If no statistics have been carried out, statements such as "statistically significant" are forbidden! Statements of significance are only permitted if supported by statistics. Statistical information must be provided to support the validity of such statements.
In general, the results are initially presented without any evaluation. The results should be presented in a clear and understandable way for the reader. Furthermore, it is particularly important to structure this part well so that the reader can understand everything.
The results are then discussed. Depending on the scope, this can be done in the same chapter, or results and discussions can be described separately. However, it must always be clear to the reader which results the discussion refers to! In the discussion, the results are critically evaluated. In addition, it should be explained whether, to what extent and why the results obtained, or the hardware or software tested in the subject study fulfilled the objective and whether the hypothesis was confirmed or refuted.
Comparisons should also be made with results presented in the literature from the basic part.

### 1.3.6 Summary and conclusion

After the detailed presentation of the results and their discussion, a summary should be prepared at the end. The most important points should be presented briefly and concisely (!). In particular, the relevance of the results about known theories or the state of research and development should be addressed, without making (general) statements that do not substantiate the results! Finally, the paper is concluded with a short outlook into the future. Possible points for an outlook are ideas for possible further development, suggestions for improving one's own method or the experimental setup, etc. It should be noted that this part is only a rounded conclusion and should therefore not be written in too much detail.

# 2 Formal design

There are two basic goals in the formal design of a text:

- Fulfilment of the general requirements for an (engineering) scientific text
- To create an attractive and easily readable document

A basic rule of formatting, the common “less is more” should be considered here, which can be applied to things like the number of fonts used, font sizes, font shapes, header and footer elements, paragraphs, levels of outline, etc.

## 2.1 Formal structure

The following structure of the thesis text is binding. Text parts that can be optionally omitted are marked with "(optional)".

**Cover page**
The cover sheet includes the topic, name and matriculation number of the editor, faculty, department and chair where the thesis was written, names of the first and second examiners, name of the supervisor and the submission date (date on which the thesis was actually submitted, not the last possible date). An example of this can be found in Figure 1 in the appendix.

**Abstract (optional)**
An abstract is a condensed one-page presentation of the work, usually written in both English and German, regardless of the language of the rest of the text.

**Declaration on oath**
The student hereby assures that he/she has only used the approved resources to complete the work. Failure to make this declaration may result in failure of the submitted work.
The text is fixed and should be adopted as this, even if the rest of the text is written in English:

> *„Ich versichere an Eides Statt durch meine Unterschrift, dass ich die vorstehende Arbeit selbstständig und ohne fremde Hilfe angefertigt und alle Stellen, die ich wörtlich oder annähernd wörtlich aus Veröffentlichungen entnommen habe, als solche kenntlich gemacht habe, mich auch keiner anderen als der angegebenen Literatur oder sonstiger Hilfsmittel bedient habe.*
> *Ich versichere an Eides Statt, dass ich die vorgenannten Angaben nach bestem Wissen und Gewissen gemacht habe und dass die Angaben der Wahrheit entsprechen und ich nichts verschwiegen habe.*
> *Die Strafbarkeit einer falschen eidesstattlichen Versicherung ist mir bekannt, namentlich die Strafandrohung gemäß § 156 StGB bis zu drei Jahren Freiheitsstrafe oder Geldstrafe bei vorsätzlicher Begehung der Tat bzw. gemäß § 163 StGB bis zu einem Jahr Freiheitsstrafe oder Geldstrafe bei fahrlässiger Begehung.“*

At the end, the declaration must be signed and dated.

**Table of content**
The table of contents contains all outline items of the text up to the 3rd outline level with the corresponding page numbers. The outline levels are marked by indentation.

All indexes must also appear in the table of contents. The page numbers are given in Roman numerals, with the cover page counted as the first page.
From the page of the introduction onwards, counting is in Arabic numerals starting with the number 1.

**List of figures**
A list of all illustrations used in the text with page number and source reference for illustrations not produced by the author. The illustrations are either numbered consecutively or according to the scheme <chapter><number>.

**List of tables**
A list of all tables used in the text with page number and source reference for tables not generated by the author. The tables are to be numbered analogously to the figures. A list of tables is also created if there is only one table.
If there is no table, the list is redundant.

**List of abbreviations**
In the list of abbreviations, abbreviations used are listed in alphabetical order and briefly explained. Abbreviations should be used sparingly. Commonly used abbreviations such as above, e.g. and etc. are excluded.

**Formula directory (optional)**
If formulas are used in the work, the formula symbols used appear in the list of formulas with a short explanation (e.g., t = time, fs = sample rate).

**Main text**
The actual thesis text with all previously presented chapters.

**Bibliography**
The bibliography is a list of all text sources used in the paper and referred to in the main text.
The IEEE standard for engineers is used for citations. In continuous text, the citation comes after a sentence and is followed by the full stop ending the sentence.
How the citation works in detail is explained in [1].

**Appendix (optional)**
The appendix can contain supplementary material that seems important for the completeness of the work and does not belong in the main part. This can include construction plans, excerpts from the source code, etc. At this point it should be mentioned again that the source text should **NOT** be printed in full in the appendix either!

## 2.2 Text design

The requirements for text formatting are often over- or underestimated. A well-formatted document increases readability enormously, but nevertheless the effort for text formatting should not exceed a certain limit, because even if the form can enhance the content, there is no substitute for good content.

### 2.2.1 Font

If possible, a document should contain only one font, which is used for headings as well as for the text and figure captions. Common fonts for writing scientific texts are Arial and Times New Roman. Which one is chosen is up to personal preference.

### 2.2.2 Font size

Font sizes between 10pt and 12pt are considered easy to read in printed form. It should be noted that different fonts have different effects with the same size specification.
Recommendation: Font size 12pt

### 2.2.3 Page design

The entire paper should be formatted on one side, as it will have to be printed on one side at the end. Sensible margins are a crucial element for good readability of texts. Nevertheless, there is no one rule for page layout. For one-page formatting, the basic rule is:

- Left and right margins are the same size, but a gutter of 1 cm must be added to the left margin so that the margins are really the same size after binding
- The lower margin is slightly larger than the upper margin because the optical center is higher than the geometric center
- Page margins should be chosen generously
- The margin should be set before writing and should not be changed afterwards

Recommendation: left: 3,0 – 3,5 cm
right: 2,0 – 2,5 cm
up: 1,5 cm
down: 2,0 cm

### 2.2.4 Header and footer

The headers and footers are intended to make working with a document easier. For this purpose, they contain useful information such as page number, author name, chapter numbers and/or headings.
Page numbers are best placed in the bottom right-hand corner, as this makes it easier to browse through the document quickly and thus to find specific parts of the text.

### 2.2.5 Line spacing

Line spacing helps the reader to separate the individual lines when reading. A simple line spacing is sufficient for this purpose.

### 2.2.6 Paragraphs

New paragraphs are marked by paragraph spacing or an indented first line. If spacing is to be used, no extra blank line should be added. If necessary, a slightly larger line spacing can be inserted. This should then be used consistently throughout the document.
In addition, all paragraphs should be justified. To avoid unnecessarily large spaces between individual words, automatic hyphenation should be inserted for the entire document.

### 2.2.7 Highlights

Individual words in the text can be highlighted in italics. This does not interrupt the flow of reading. If the flow of reading is to be deliberately interrupted or if the emphasis serves to structure the document, boldface can also be used. If possible, whole words in capital letters should be avoided, unless they are proper names.

### 2.2.8 Headlines

A uniform font for all heading levels guarantees a clear layout. More than four levels of headings should not be used, and the fourth level should not appear in the table of contents or be numbered.
To fulfil their purpose as a thread running through the text, headings do not require any special formatting, but first and foremost space. A heading must be clearly distinguishable from the preceding text block and, of course, must not merge with the new one.
Recommendation: Make all headings bold and number them with Arabic numerals (as in this document).
$\text{Font size}_{\text{Level4}} = \text{Font size}_{\text{main text}}$
$\text{Font size}_{\text{Level3}} = \text{Font size}_{\text{Level4}} + 2\text{pt}$ etc.
→ for text size 12pt: Headline 4 = 12pt
Headline 3 = 14pt
Headline 2 = 16pt
Headline 1 = 18pt
Before each heading, a spacing the size of the heading should be set, after the heading a slightly smaller one, but at least the size of the font of the main text. After heading 4, single line spacing should be used.

## 2.3 Formal details

In addition to the issues of text formatting, there are other formal characteristics that need to be considered when writing a scientific text or thesis.

### 2.3.1 Spelling

If the work is written in English, it is important to specify whether the American or British spelling is to be used. Under no circumstances should a mixture be made.

### 2.3.1 Foreign and technical words

Foreign words should be used in an appropriate number, as too many foreign words make a text incomprehensible. Foreign words are useful when

- There is no common English word for the facts of the case
- A fact would have to be laboriously paraphrased without foreign word
- It is a technical term

### 2.3.2 Abbreviations

Abbreviations should be used sparingly unless they are commonly used (e.g. "e.g.", "etc.", "or", "etc."). All other abbreviations should be listed in brackets after the full word the first time they are used and included in the list of abbreviations. Once an abbreviation has been introduced, only the abbreviation should be used for the flow of reading, and not the full word (except in the case of headings).
Example: *"I am writing my thesis at the Department of medical Technology Systems (SMT). The SMT department has its offices in building BB."*

### 2.3.3 Quotes

Citations are used to prove the accuracy of information and to support opinions. A citation is followed by a reference to the source in parentheses (see also "Bibliography"). In engineering scientific papers, it is common to use the IEEE standard. A more detailed explanation can be found in [1].

The author should be able to judge for himself how important it is to find an exact passage in the text or whether it is sufficient to cite an entire chapter as a source. If the text is an argumentative writing, it is certainly essential to give the reader the possibility to easily find the text passage given to support one's own statement. When describing a practical project, on the other hand, literature sources often only serve as a reference for generally known and undisputed knowledge, so that it is only important to show which work this knowledge was taken from.

**Direct quotes**
A direct quotation is a text passage that is taken word for word from the original text. Verbatim text passages are marked with a quotation mark.
Omissions within a literal quotation are indicated by "[...]". Your own insertions (to fit the quotation into a separate sentence) are placed in square brackets. Of course, omissions and insertions must not change the meaning of the original sentence!
If a quotation begins or ends within an original sentence, the quotation is introduced or expelled with "...", unless the quotation is embedded in its own sentence.
Inverted commas in quotations are replaced by single inverted commas.
Literal quotations should be used sparingly, as it is not necessary to quote page after page, but only one or two short sentences when exactly this formulation is needed.
A verbatim passage not marked as a citation is one of the worst violations of the rules of academic work as well as most common examination regulations. This will inevitably lead to a graduate failing!

**Indirect quotes**
Indirect quotations are understood to be rephrasing's of text passages as well as the adoption of foreign thoughts and argumentations and, in the technical field, specifications. The source of the citation is given after the statement in question. The reference to the author can also be made in the text, but the source must still be inserted at the end of the sentence/section.

### 2.3.4 Bibliography

The bibliography contains the complete list of all sources cited in the paper (books, journals, conference articles, papers, websites, etc.). The bibliography is sorted chronologically according to the use of the sources and contains for each entry at least the title of the source work, the author, the publisher, and the year of publication.
Since documents taken from the internet might not be accessible after some time, the date of access should be indicated for such sources (see bibliography of this document).
Furthermore, there should be an awareness that the traceability of sources is the most important element. If an argumentation is mainly or exclusively based on an internet source, it is up to the student to check whether this source is still available in the period in which the work is assessed. An important source that can no longer be found will certainly not arouse any enthusiasm on the part of the examiners. In case of doubt, it should be saved elsewhere.

# 3 General tips

At the end of this guide, we would like to make a few general remarks and describe the most important stumbling blocks.

## 3.1 Speeches and content

- The reader should be guided through the text, i.e., new bullet points should be provided with introductions and paragraphs should be connected by transitions.

- Short, concise sentences are more meaningful than long, complicated, and convoluted sentence constructions. Scientific ability is demonstrated by the fact that a complex issue can be explained in a comprehensible way.

- The "I" form does not belong in a thesis, nor does colloquial language or passive paraphrases ("It was agreed upon"). Exceptions (regarding "I") concern the conscious expression of one's own point of view (contrary to others) or the emphasis of a decision within the framework of a development. But here, too, the attempt should be made to remain in the passive voice as far as possible.

- The text should be uniform in its design features. This applies to the use of the same abbreviations once they have been introduced as well as, for example, a uniform layout for lists (first letter small or large, full stop at the end or not, etc.).

- In any case, the author knows more about the topic than can be written in the text. Only the knowledge that is important for understanding the thesis and only the findings that have something to do with the task should be included in the thesis text. The fear that the text might not be long enough and the resulting urge to lengthen it artificially with interesting but irrelevant chapters should be suppressed from the beginning. As a rule, the relevant material is quite sufficient to produce a text of far too great a length.

- The comprehensibility of the text stands and falls with a sensible structure. If certain chapters cannot be arranged in a meaningful way despite intensive attempts, a restructuring may be advisable.

- The work is aimed at professionals who have general basic knowledge and an overview of the problem. Accordingly, only terms and facts that deal with the topic in more detail need to be explained (in case of uncertainty, consult the supervisor, if necessary, about what should be explained and what can be taken for granted).

- Engineering texts thrive on visualisation through images, tables, diagrams, and lists. However, their use should not exceed a reasonable level.

## 3.2 Thesis and word processing

In addition to the well-known Microsoft Word, LaTeX can also be used as a text processing programme. LaTeX generates a text almost automatically with the help of the common typographic rules. If you have never worked with LaTeX before, you will need to get used to it. In principle, the use of LaTeX makes sense if a lot of mathematical formulae are used within the work. In addition, the emphasis on outline structure forces the writer to structure the text clearly.

When used correctly, a word processor can save the author a lot of work. If used incorrectly, on the other hand, it causes considerably more work. For this reason, the following sections provide some tips on how to handle large texts.

### 3.2.1 Start with the content, not with the form

Write first, then format. If, after writing each chapter, too much work is put into formatting in the form of placing figures on the page or similar, a lot of time will be lost, as this formatting will be obsolete with changes to the text or different sentence structures.
During the writing process, the focus should be on the text itself and only on assigning structural information, such as format templates, to the right places to simply create automated directories at the end. The basic formatting is usually sufficient for the time being. Detailed formatting should be done at the end. Only the margins should be defined at the beginning so that you do not find out at the end that there is far too little space for far too much text.

### 3.2.2 making space by making space

Most problems with formatting arise at the end because paragraphs or page breaks have been caused by additional blank lines. This must be prevented at all time!
In Word as well as in LaTeX, paragraphs can be inserted by certain commands that do not shift everything when a sentence is changed in the middle of the text, thus saving an incredible amount of work.
If you have never created a large text document before, you will find solutions for every problem on the Internet. Even if the search takes a little time at first, it saves a lot of time in the end.
A page break should also never be inserted with several blank lines. There are many possibilities for this in Word under "Layout" → "Page breaks". In LaTeX, the simple command \newpage is quite sufficient.

### 3.2.3 Outline instead of format

To find out whether a word should be written in italics, bold or larger, you should not listen to your feelings, but always clarify the question of which structure the word belongs to. For example, is it a heading, a simple text part, a quotation, or a caption? In most cases, all other questions can be answered by answering this question.
In Word, it is a good idea to use the format templates suggested by Word for formatting. These can also be adapted to your own wishes by right-clicking on the template. It is usually sufficient to use the following format templates:

- Headlines 1 – 4
- Text body
- Header and footer
- Labelling
- Bullets 1 – 4
- List number 1 – 4

### 3.2.4 Don’t count – let it count

The already limited editing time of projects should not be spent on manually counting figures or tables. To avoid this, pictures, tables, diagrams, etc. can be provided with a caption that is automatically adjusted as soon as a picture is removed or added.

This caption is created by right-clicking on the element and then selecting the item "Caption". In the field that now appears, you can also specify the type of element (picture, table, etc.). The corresponding directories are then created via the tab "References" → "Captions" → "Insert List of Figures". With the help of this button, all the lists of figures that are needed are created.
When numbering the headings, care must be taken that they are not recognised as a list and are automatically indented.

### 3.2.5 Images and graphics

To create a uniform appearance, a few things should be considered when inserting images and graphics:

- Always insert images and graphics with the same layout (context menu → Properties).
- The layout "With text in line" is usually the least problematic. In this case, the image is linked to a specific paragraph, which is also usually the case in terms of content.
- Unless absolutely necessary, the flow of text should not be interrupted by images. This means that no images should be embedded in the text or placed next to the text.
- The exact positioning of the images should only be considered at the very end, when nothing more is changed in the text.
- To edit images, PowerPoint can be used, for example, and then a *.jpg file (Word) or vector graphic (LaTeX) can be created from the individual slide, which can then be cut and pasted.

### 3.2.6 Cross-references

If something is to be referenced, the function "Insert" → "Cross-references" can be used in Word. All illustrations can be referenced so that the numbering also changes in the text and there is no reference to a wrong illustration at the end. In LaTeX, this can be done with the command \ref{}.
Individual chapters or pages can also be referenced, if desired.

### 3.2.7 Mastering Headers / Footers - Sections

It is quite common for cover pages and indexes to be numbered differently from the main text (= cover page not numbered at all; indexes numbered in Roman). Likewise, the need to use different headers may arise. To achieve this, the document must be divided into different sections in Word ("Layout" → "Page Setup" → "Breaks"). Each section can then be given its own numbering, header, footer, page margins, etc. To assign the headers and footers to individual sections, make sure that the button "Link to previous" is deactivated in the tab "Design" → "Navigation". If this is not the case, the changes are automatically applied to all sections.

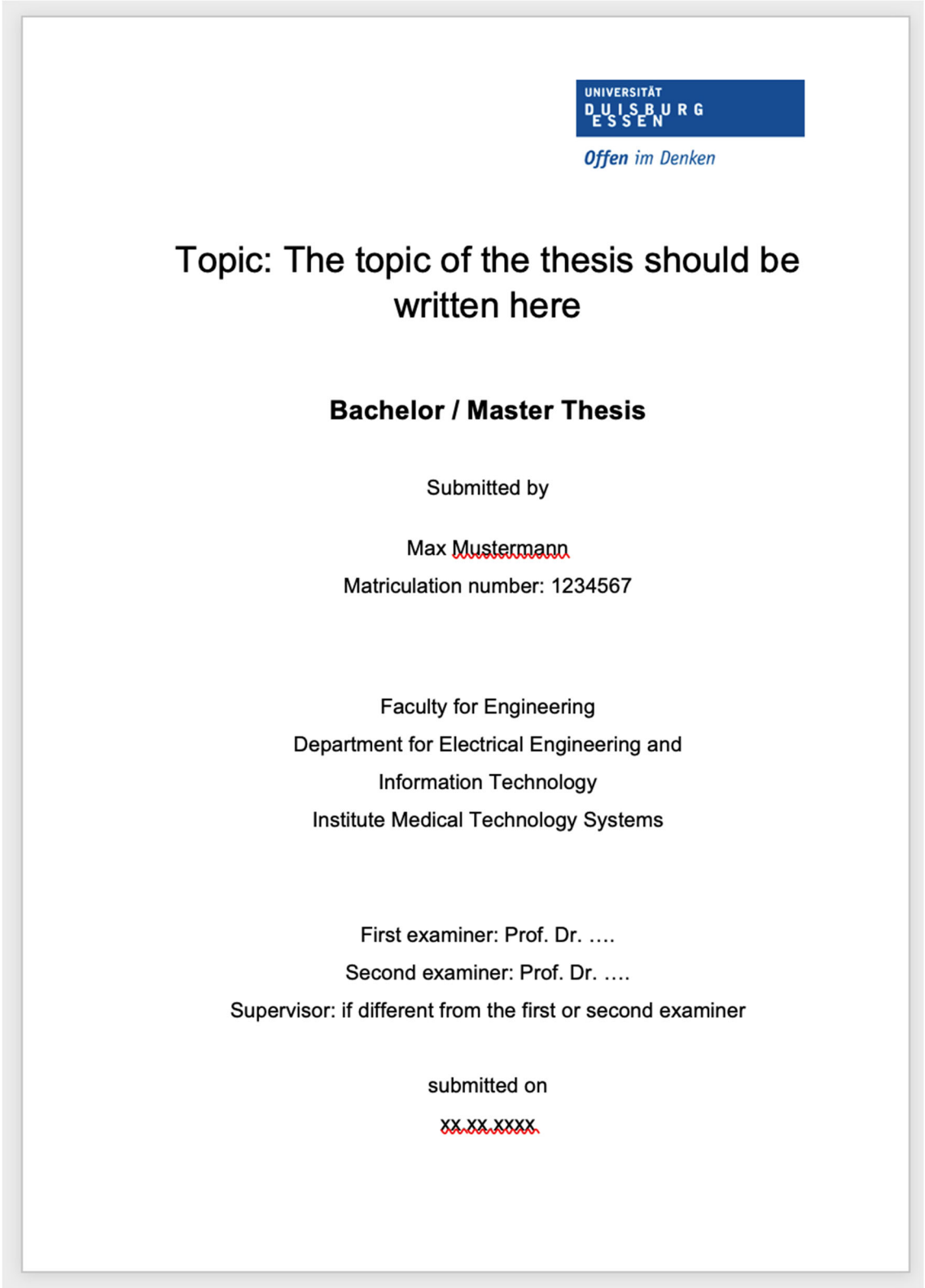
### 3.2.8 Last but not least

During the preparation of the written work, a backup document of the current version should always be available in case the document breaks or the computer crashes. It is also recommended that automatic saving via OneDrive is activated in Word. Here, the previous versions can be restored in case something was accidentally changed that cannot be easily undone or the error is not found. All this saves a lot of work and nerves.

# Bibliography

[1] T. L. -. U. o. Bath, “University of Bath,” Juli 2021. [Online]. Available: https://www.bath.ac.uk/publications/library-guides-to-citing-referencing/attachments/ieee-style-guide.pdf. [Accessed 04 März 2022].

# Appendix



UNIVERSITÄT DUISBURG ESSEN

*Offen* im Denken

Topic: The topic of the thesis should be written here

**Bachelor / Master Thesis**

Submitted by

Max Mustermann

Matriculation number: 1234567

Faculty for Engineering

Department for Electrical Engineering and Information Technology

Institute Medical Technology Systems

First examiner: Prof. Dr. ….

Second examiner: Prof. Dr. ….

Supervisor: if different from the first or second examiner

submitted on

xx.xx.xxxx

*Figure 1: Example of a cover page*