

---

# Template for Academic Theses at TH Köln

Bachelor's/Master's thesis to obtain the academic degree  
*Master/Bachelor of Arts/Engineering/Laws/Science*  
in the degree program <name of degree program>  
at the Faculty of <name of faculty>  
of the TH Köln – University of Applied Sciences

Submitted by: First Name Last name  
Matriculation no.: 123 456 789  
Address: Betzdorfer Str. 2  
50679 Cologne  
name.surname@smail.th-koeln.de

Submitted to: Prof. Dr. First name Last name  
Second reviewer: Prof. Dr. First name Last name

Place, dd.mm.yyyy

## **Abstract**

A summary (if required) in German and/or English (abstract) comprises the presentation of the problem, the method(s) used and the most important result on about 1/2 to 1 page.

You can find out how to write a successful abstract in the seminars or by consulting the Center for Soft Skills Development<sup>1</sup>.

Key words/key phrases: if necessary, provide 3 to 10 key words.

---

<sup>1</sup><https://www.th-koeln.de/schreibzentrum>

# Content

<b>List of Tables</b>	<b>IV</b>
<b>List of Figures</b>	<b>V</b>
<b>1 Introduction</b>	<b>1</b>
<b>2 Formal Structure</b>	<b>3</b>
2.1 Sequence . . . . .	3
2.2 Cover Page . . . . .	3
2.3 Table of Contents . . . . .	4
2.4 List of Figures and Tables . . . . .	4
2.5 List of Abbreviations . . . . .	4
2.6 Bibliography . . . . .	4
2.7 Spelling, Grammar . . . . .	5
2.8 Scope of the Thesis . . . . .	5
<b>3 Layout: Typesetting with L<sup>A</sup>T<sub>E</sub>X</b>	<b>6</b>
3.1 Under the hood . . . . .	7
3.2 Headings . . . . .	7
3.3 Paragraphs . . . . .	7
3.4 Hyphenation . . . . .	8
3.5 Enumerations . . . . .	8
3.6 Illustrations . . . . .	8
3.6.1 Images . . . . .	9
3.6.2 Vector Graphs . . . . .	10
3.7 Tables . . . . .	10
3.8 List of Figures and Tables . . . . .	11
3.9 Equations . . . . .	11
3.10 Source Code, Pseudocode . . . . .	12
3.11 Further Directories . . . . .	13
3.11.1 Creating a Glossary . . . . .	13
3.11.2 Creating a List of Abbreviations . . . . .	14
3.11.3 Creating a List of Symbols . . . . .	14
3.12 References . . . . .	14

3.13	Special Spaces and Signs . . . . .	15
3.14	Selecting the Basic Font . . . . .	15
3.15	Metadata for the pdf Viewer . . . . .	16
3.16	Switch Between Single and Double-sided Layout . . . . .	16
3.17	Compile . . . . .	16
3.18	This Template . . . . .	17
<b>4</b>	<b>Citations and References</b>	<b>19</b>
4.1	Citations . . . . .	19
4.1.1	References . . . . .	19
4.1.2	Ibid . . . . .	20
4.1.3	Secondary Quotations . . . . .	20
4.1.4	Citing Figures and Tables . . . . .	20
4.2	Bibliography . . . . .	21
4.2.1	Content and Order of the Bibliography . . . . .	21
4.2.2	References in the Bibliography . . . . .	21
	<b>Bibliography</b>	<b>23</b>
	<b>Appendix</b>	<b>26</b>

**List of Tables**

3.1 A simple table . . . . . 11

**List of Figures**

3.1	Perhaps this is art? . . . . .	9
3.2	A beautiful graphic generated in the source code! . . . . .	10
3.3	Example of a listing . . . . .	13

# 1 Introduction

This document template can be used as a model for academic theses. It is based on guidelines created by Prof. Dr Stephan Freichel as Chairman of the Examination Board for the B.Sc. Logistics and M.Sc. Supply Chain and Operations Management degree programs at the Faculty of Automotive Systems and Production.

The text in this template describes general formal requirements, in particular for the table of contents, the insertion of references and the compilation of a bibliography.

The template can be used interdisciplinary as a sample file for theses at TH Köln. However, when using it, you must make sure that it complies with the conventions of your degree program.

The content of the document was revised and modified by Maria-Anna Worth (retired) and Susanne Neuzerling (Department of Planning and Controlling) to make it suitable for use across all subjects. A further revision and update was carried out by Andreas Bissels (Writing Centre). Ms. Katharina Bata created the document template in LaTeX. This template was last revised in 2023 by André Ulrich and Jan Salmen and supplemented with various notes, specifically on design with L<sup>A</sup>T<sub>E</sub>X (see chapter 3). The document was translated by Lynne Lörler (Language Learning Center).

To prepare for your final thesis, we recommend that you take advantage of the services offered by the Writing Center of the Center for Soft Skills Development<sup>1</sup>; these include both counselling<sup>2</sup> and courses<sup>3</sup> on academic writing. The Writing Center is your point of contact at TH Köln for questions relating to academic writing. Additionally, the Language Learning<sup>4</sup> Center offers counselling<sup>5</sup> on writing in English.

Please save this document template twice on your computer: once so that you can continue to access the content presented here, and a second time so that you can overwrite it with your own thesis.

---

<sup>1</sup><https://www.th-koeln.de/schreibzentrum>

<sup>2</sup><https://www.th-koeln.de/schreibberatung>

<sup>3</sup><https://www.th-koeln.de/schreibzentrum/seminare>

<sup>4</sup><https://www.th-koeln.de/sprachlernzentrum>

<sup>5</sup>[https://www.th-koeln.de/internationales/schreibberatung-englisch-fuer-studierende\\_84724.php](https://www.th-koeln.de/internationales/schreibberatung-englisch-fuer-studierende_84724.php)

*Please note: This template does not supersede the specific requirements of the respective examination boards. If there are special formal requirements in your subject, these apply.*

Cologne, November 2024

## **2 Formal Structure**

In this chapter you will find basic information on the formal structure of your thesis.

### **2.1 Sequence**

A scientific paper usually consists of the following parts:

1. Cover sheet
2. Abstract (optional)
3. Table of contents
4. List of figures and tables (also common at the end)
5. List of abbreviations (also common at the end)
6. Introduction
7. Main part
8. Summary/conclusions
9. Bibliography
10. Appendices (optional)
11. Declaration

### **2.2 Cover Page**

The cover page includes: title of the thesis, type of thesis, author, matriculation number, submission date, supervisor and second reviewer. For theses longer than 15 pages, the cover page is included in the number of pages but not numbered.

## 2.3 Table of Contents

We recommend a decimal structure as laid out in this document. If subheadings are used within a chapter, there must be at least two: where there is a 2.1, there must be a 2.2.

The table of contents always contains the page references for the listed items; however, it is not listed in the table of contents itself. The pages that the table of contents itself takes up can be counted in Roman numerals.

For a thesis, a structure of at least three levels is usually used. As a rule, only up to four levels are shown in the table of contents. However, you must find out about and consider the conventions in your subject.

## 2.4 List of Figures and Tables

Figures and tables are listed in corresponding directories. In this template, they appear directly after the table of contents. The corresponding pages can then be numbered in Roman numerals. However, the lists can also be placed at the end of the work before or after the bibliography. In this case, they are given regular page numbers.

## 2.5 List of Abbreviations

The number of abbreviations should be kept to a minimum. The list of abbreviations only contains important subject-specific abbreviations in alphabetical order, in particular abbreviations of organisations, associations or laws. Common abbreviations such as i. a., e. g., etc. are not included.

For technical implementation with  $\text{\LaTeX}$ , see also section 3.18.

## 2.6 Bibliography

The bibliography is organized alphabetically by author name. It contains all sources cited in the text - and only these. Several writings by the same person are organized by year of publication. You must distinguish between writings by the same person from the same year of publication. In engineering, a number or author abbreviation is

often placed before the name in square brackets. You can learn more about this and other important rules of citation in the Writing Centre's e-learning courses<sup>1</sup>.

Appropriate software tools such as Citavi or Zotero, which are compatible with various word processing programs, are suitable for managing the literature used.

## 2.7 Spelling, Grammar

When submitting your work, make sure that your German or English is flawless. If errors impair readability, this can have a negative impact on your grade. It is therefore essential that you use the spell checker in your word processing programme, even if it does not detect all errors.

For those who feel unsure about this topic, we recommend the Writing Centre's e-learning courses<sup>2</sup>. If necessary, please also contact the representative for students with disabilities<sup>3</sup>.

## 2.8 Scope of the Thesis

All subjects specify binding upper and lower limits that must generally be adhered to. Indexes and appendices are generally not counted. In individual cases – especially in the case of empirical work – deviating agreements can be made with the supervisor.

---

<sup>1</sup>[https://ilu.th-koeln.de/goto.php?target=cat\\_52109&client\\_id=thkilu](https://ilu.th-koeln.de/goto.php?target=cat_52109&client_id=thkilu)

<sup>2</sup>[https://ilu.th-koeln.de/goto.php?target=cat\\_52109&client\\_id=thkilu](https://ilu.th-koeln.de/goto.php?target=cat_52109&client_id=thkilu)

<sup>3</sup>[https://www.th-koeln.de/studium/studieren-mit-beeintraechtigung\\_169.php](https://www.th-koeln.de/studium/studieren-mit-beeintraechtigung_169.php)

### 3 Layout: Typesetting with L<sup>A</sup>T<sub>E</sub>X

It is relatively easy to create documents with L<sup>A</sup>T<sub>E</sub>X that meet professional standards. A decisive advantage is that the user contributes almost only the content, while the correct external form is then generated automatically. L<sup>A</sup>T<sub>E</sub>X is based on T<sub>E</sub>X, which was developed by Donald Knuth [5]. Some further advantages over conventional word processing are:

**Free/platform-independent:** L<sup>A</sup>T<sub>E</sub>X is free software. No proprietary editor is required to write L<sup>A</sup>T<sub>E</sub>X documents. In fact, the documents can be edited on *any* computer with *any* editor.

**Pure text format:** The source text – the `tex` file – is a pure text format. This makes L<sup>A</sup>T<sub>E</sub>X documents ideal for version control with git, for example. This in turn enables efficient collaboration between multiple authors.

**Splitting large documents:** The source text of large documents, such as project work, can be split into several files. Thus several people can each work on a separate chapter. Due to the two points above, there are no compatibility problems

**Separating layout/content:** With L<sup>A</sup>T<sub>E</sub>X, you can explicitly define the layout for the entire document – or the document class used implicitly takes care of this. Style sheets of modern word processing provides corresponding functionalities but the programmatic approach with L<sup>A</sup>T<sub>E</sub>X allows you to influence the layout even more precisely. Then you can concentrate fully on writing.

**Professional result:** A document created with L<sup>A</sup>T<sub>E</sub>X looks more professional than a corresponding document created with word processing. This is especially true for math-heavy documents. But other documents can also benefit from a uniform layout, consistent gray value of the continuous text, more consistent page breaks and high-quality vector graphs - to name just a few points.

**Versatile:** L<sup>A</sup>T<sub>E</sub>X can be used to create more than just “simple” documents. There are countless document classes that can also be used to create presentations or posters, for example.

The following sections 3.1 to 3.18 deal with various aspects that you should consider when creating your document.

## 3.1 Under the hood

In your T<sub>E</sub>X documents, you define what your content is (text with structure, images, tables, references, ...) and how it should roughly look in each case (e.g. placement of images using *floating environments*, see section 3.6).

When creating the final document, L<sup>A</sup>T<sub>E</sub>X applies a whole host of rules “under the hood” that determine how everything can be implemented in the best possible way. These rules concern, for example, the proportion of text and images per page, spacing within lines, but also special cases such as avoiding individual lines of a section alone on a page (so-called “orphans” or “widows”).

As a result, for example, your illustrations might “jump” while you are working on your text. This may well be correct and can be optimized at the end if necessary.

In this context, avoid interfering with the design process, e.g. by manually inserting line breaks (“`\newline`” oder “`\\`”) or spacing. Please only make exceptions in justified cases, as in this template for the design of the cover page.

Further information on how you can continue working with this template can be found in section 3.18.

## 3.2 Headings

In this template, we use the chapter (“`\chapter`”) as the highest level of structure. This is followed by sections (“`\section`”) and subsections (“`\subsection`”). These three levels are numbered and appear in the table of contents. If you want to structure your text further, there is also the “`\paragraph`”-command.

Please note that two headings should never directly follow each other in the text. A heading should always be followed by some text (see, for example, the beginnings of the chapters here on page 3 and page 6). For further information, see section 2.3.

## 3.3 Paragraphs

Places in the text where a new paragraph should begin can be marked in the source code with “`\par`”. The exact appearance of these paragraphs in the finished document is determined by the parameter “`\parskip`” in the document class – more on this in section 3.18. This is a major advantage of L<sup>A</sup>T<sub>E</sub>X: the style can be easily changed at any time for the entire document.

Note: You will also get the same results if you leave a blank line in the source code instead of using the “`\par`” command. You may like this even better

## 3.4 Hyphenation

The automatic hyphenation in L<sup>A</sup>T<sub>E</sub>X works well in principle. However, there can always be minor problems and undesired results. If you want to influence the hyphenation for a specific word, you can use the “`\hyphenation`” command to manually specify the permitted hyphenation location. This allows you to ensure that certain words are never hyphenated, for example proper names.

For example, words containing a hyphen are *only* separated there, which can lead to lines not being displayed correctly, resulting in a warning (see section 3.17). In such cases, you would have to specify additional separators manually in the source code.

## 3.5 Enumerations

Use the environments

- “`\begin{itemize}`” ... “`\end{itemize}`”
- “`\begin{enumerate}`” ... “`\end{enumerate}`”
- “`\begin{description}`” ... “`\end{description}`”
- “`\begin{labeling}`” ... “`\end{labeling}`”

to create attractive lists. Here too, the exact appearance is set globally in the document; you can change this at any time, more on this in section 3.18.

## 3.6 Illustrations

When someone looks at your finished thesis, it may well be that they first leaf through it roughly, hardly reading the text but looking at the illustrations. Hence the “rule” that you should be able to understand the most important points of the thesis in this way.

Illustrations never stand alone but are described by the *caption*. It should contain everything that is necessary to understand the illustration. Only in exceptional cases

must the caption refer to the text. Conversely, each figure must be referenced at least once in the text, see also section 3.12.

In the following two sections, a distinction is made between images (in section 3.6.1) and vector graphs (in section 3.6.2), as these are completely different techniques that should be used appropriately in each case.

Remember that not everyone can see all colors equally well. Around 10% of men in Germany, for example, are affected by red-green color-blindness. Your thesis may also be printed in black and white. Therefore, you should ideally design illustrations in such a way that they are understandable even without colors.

### 3.6.1 Images

You can include images with “`\includegraphics`”. It is sufficient (and even recommended!) to specify the file name without an extension and without a path. When compiling, all directories specified in “`\graphicspath`” are searched. As a rule, an image should not appear alone in the document, but in an environment which ensures



Figure 3.1: Perhaps this is art?

automatic numbering, adds a caption and finally enables the figure to be placed in an optimal position (hence the term “floating environment”). In this case, this is the “`\figure`” environment.

For the environment, we set where it may appear (see also section 3.1). Here `t` stands for the top of the page, `b` for the bottom and `h` for “here”, which means the positioning within the text. If you need to save space, `t` and `b` are preferable.

Attention: Many contents such as formulas, code, diagrams, visualization of data, etc. should not be inserted as an image, but in a suitable form. See the following section on vector graphs.

### 3.6.2 Vector Graphs

You do not need to insert simple illustrations (e.g. coordinate systems, flowcharts, etc.) as an image. Instead, you can generate them directly in the source code. The powerful “`tikz`” package is ideal for this.

One advantage is that your document remains smaller. Another is that the illustrations usually look more attractive. This is especially true when viewing on a screen, as vector graphs can be scaled to any size. This even allows you to display your data, e.g. from experiments, separately and generate corresponding images dynamically from them. See the example in figure 3.2.

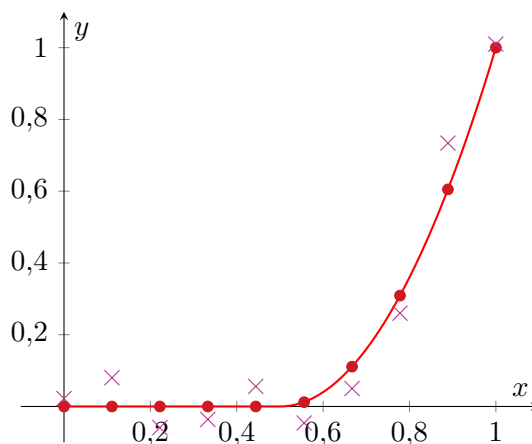


Figure 3.2: A beautiful graphic generated in the source code!

You can of course find lots of examples of TikZ on the Internet. There is also an up-to-date book [15].

## 3.7 Tables

Basically, tables in L<sup>A</sup>T<sub>E</sub>X are created with the “`\tabular`” environment. This is then just the table itself, without numbering and without a caption. The principle is therefore the same as for images (see above): First the environment (here “`\table`”), in it the table itself. Perhaps the commands `rowcolor` or `multicolumn` will be useful for you at some point. There are many other packages that help to create even more attractive tables, for example `array`, `booktabs` and `tabularx`.

Überschrift links	Überschrift rechts
1	2222
10	222
100	22

Table 3.1: A simple table

### 3.8 List of Figures and Tables

L<sup>A</sup>T<sub>E</sub>X allows you to create figure and table directories automatically. All entries for which you have correctly created floating environments will appear accordingly (see section 3.6.1 und 3.7).

The text from the `caption` is used by default for these directories. This description is often too long. You can therefore opt to specify a shorter version in square brackets in the caption. See also section 4.1.4.

### 3.9 Equations

One of the greatest strengths of L<sup>A</sup>T<sub>E</sub>X is that you have many possibilities to write down formulas simply and beautifully. In this context, the “`amsmath`” package is particularly popular because it offers so many possibilities. Here is just a small example with the “`align`” environment:

$$\sum_{i=1}^n i = 1 + 2 + \dots + (n-1) + n \quad (3.1)$$

$$= (1 + n) + (2 + (n-1)) + \dots \quad (3.2)$$

$$= \frac{1}{2} \cdot (n+1) \quad (3.3)$$

However, simple formulas in the text such as  $x \in \mathbb{N}$  are of course also possible. A common mistake here is that the “math mode” is forgotten in the text: We are talking about the  $x$ -value and *not* the x-value.

The error is just as common the other way round, i. e. text is written in math mode:  $a_{wrong} = 42$ , but  $a_{correct} = 42$ , perhaps also  $a_{\text{correct}} = 42$ .

Functions such as  $\sin$  are automatically displayed well, as in

$$\sin \alpha = \left( \frac{a}{c} \right) \quad (3.4)$$

The brackets have only been inserted here to demonstrate the corresponding mechanism: automatic scaling of brackets!

Sometimes you want to use your own “Operator” that should look the same. This is exactly what the “`\DeclareMathOperator`” command is for, allowing you to add missing functions such as  $\operatorname{sgn}(x)$ .

It is advisable to give all mathematical symbols that you use in your work meaningful names in the source code; the easiest way to do this is with the “`\newcommand`” command. You can then customize how you want to use the weight vector  $\vec{W}$  in the entire document or what the imaginary unit  $i$  with  $i^2 = -1$  should look like. Of course, this assumes that you use the designations consistently. However, this also makes your source code easier to read!

### 3.10 Source Code, Pseudocode

If a section of the source code is to be displayed in the final thesis, the obvious idea is to simply take a screenshot of it and display it via `\includegraphics` as an image. However, this is not a good idea as when the finished document is zoomed in, the displayed source text immediately pixelates. However, L<sup>A</sup>T<sub>E</sub>X offers a more elegant alternative: The `listings` package for displaying source text – directly in the source text of the L<sup>A</sup>T<sub>E</sub>X document or read directly from an external file.

The source text can be entered directly in the L<sup>A</sup>T<sub>E</sub>X document using the `lstlisting` environment. The command `\lstinputlisting{<file>}` can be used to read and display the source text from an external `<file>`. Attention: The path to the `<file>`, relative to the L<sup>A</sup>T<sub>E</sub>X document must be specified.

The layout of the source text displayed in the finished document can also be influenced. There is a *key-value interface* for this purpose which can be used to influence things such as the font to be used or the background color with the help of special *keys*. The command `\lstdefinestyle{<style>}` is used for this purpose. Here, `<style>` is a list of several pairs of the form `<key>=<value>`, which are separated from each other by a comma. An example can be found in the preamble of this template, in the `definitions.tex` file. For further information, please refer to the documentation of the package. An example of such a source text generated with the `lstlisting` environment is given in figure 3.3.

```
\lstdefinestyle{myLaTeX}{
  language=TeX,
  basicstyle=\footnotesize\ttfamily,
  frame=single,
  backgroundcolor=\color{gray!10},
}
```

```
\begin{lstlisting}
\lstdefinestyle{myLaTeX}{
  language=TeX,
  basicstyle=\footnotesize\ttfamily,
  frame=single,
  backgroundcolor=\color{gray!10},
}
\end{lstlisting}
```

Figure 3.3: Example of a listing that has been created using the `lstlisting` environment. The finished listing is shown on the left and the corresponding source code that leads to the output is shown on the right. Coincidentally, this is an excerpt of the style used in this template.

## 3.11 Further Directories

Additional directories can be created using the `glossaries` package. A glossary and a list of abbreviations or symbols can be created directly. Additional directories can also be defined. If you want to utilize the full potential of `glossaries`, you will need Perl on the computer and the Perl script `makeglossaries`. However, there is also a “mashed-up” version with somewhat limited functionality which works completely without Perl and an external script. Please refer to the documentation of the package for this.

By using the `toc` option when loading `glossaries`, the additional directories also appear in the table of contents. If the `hyperref` package continues to be used, the entries of these directories’ output in the text are links that lead directly to the corresponding directory. The directories themselves can then be displayed at the desired position in the document using the `\printglossaries` command. Again, please refer to the package documentation for further information.

### 3.11.1 Creating a Glossary

A glossary can be used directly without any further provisions. An entry in the glossary can then be defined using the command `\newglossaryentry{⟨label⟩}{⟨specification⟩}`. Here, `⟨specification⟩` is a *key-value* list. The most important *keys* are **name** and **description**, which are used to specify the name and description of the entry to be defined. The previously defined term can then be displayed in the text using the command `\gls{⟨label⟩}`. Want an example? The Dog is man’s best friend.

### 3.11.2 Creating a List of Abbreviations

To be able to use a list of abbreviations, `glossaries` must be set with the option `textttacronym`. An abbreviation can then be defined in the preamble using the command `\newacronym{<label>}{<abbreviation>}{<written out>}`. The previously defined abbreviation can then be displayed in the text using the command `\gls{<label>}`. L<sup>A</sup>T<sub>E</sub>X then automatically ensures that the abbreviation is written out the first time it is mentioned in the text. For all subsequent mentions, only the abbreviation is then displayed. Want an example? This is a support vector machine (SVM). And here is another SVM.

### 3.11.3 Creating a List of Symbols

To be able to use a list of symbols, `glossaries` must be set with the option `symbols`. A symbol can then be defined in the preamble using the command `\newglossaryentry{<label>}{<specification>}`. The command is exactly the same as for the glossary. In addition, `type=symbols` must be specified for `<specification>`. The command `\gls{<label>}` can then be used to display the previously defined symbol in the text. Need an example? The force  $\vec{F}$  is defined according to the following equation:

$$\vec{F} = m \cdot \vec{a}$$

## 3.12 References

Set markers in your source code with the “`\label`” command. The placement indicates the numbering to which the label refers, e.g. the level (see section 3.2), table (see section 3.7), figure (see section 3.6) or equation (see section 3.9). All of these are numbered separately, which can take some getting used to at first.

You can then refer to the marked locations with the “`\ref`” command, whereby this only provides the appropriate number. You would then have to add the appropriate name, e.g. “Figure”, yourself. We have therefore included the `cleveref` package here, which automates the latter step.

Every figure and every table must be referenced in the text; no numbered environments may simply “hang in the air”. In contrast, sections and equations do not all have to be explicitly referenced. However, you can help your readers by thinking about meaningful references.

### 3.13 Special Spaces and Signs

A line break (or even a page break) can always occur at spaces. This should be avoided in some cases, partly because lines should not start with numbers. A typical example is “Lange Straße 123”. Here you need a so-called protected space after “Straße” which is created with a tilde.

Just as floating environments are optimally distributed (see section 3.1), horizontal spacing between words and sentences in L<sup>A</sup>T<sub>E</sub>X is also dynamically adjusted in each line. All dots are interpreted as the end of a sentence. In the case of abbreviations such as “e.g.”, this does not look nice, the space is too large. In this case, a half space must be created manually in the middle with “\,”. If you find typing such constructs too cumbersome, you can use define your own commands such as “\eg”. To define your own commands, see section 3.9.

As with spaces, there are also different lengths for horizontal dashes. For dashes – here, for example – or if “to” is meant (as in 14:00–16:00), the single hyphen (minus sign) is not sufficient, the appropriate space is simply created in L<sup>A</sup>T<sub>E</sub>X by a double minus.

All characters that have a function in L<sup>A</sup>T<sub>E</sub>X are problematic in the source code: Percent sign %, ampersand &, underscore \_, curly brackets {...} are typical examples. These must be entered in the source code with a backslash, otherwise you will receive error messages.

### 3.14 Selecting the Basic Font

By default, L<sup>A</sup>T<sub>E</sub>X uses a serif font for continuous text. Serif fonts are advantageous for printed work because the serifs emphasize the baseline and thus help the eye to jump back to the beginning of the next line at the end of the line. In addition, the different stroke widths lead to clearer word images and thus support the reading process.

However, if such a document is viewed on an old monitor with a low resolution, the fine serifs may no longer be displayed properly. In such a case, it may be advantageous to use a sans serif font. It may also be that sans serif fonts are preferred for reasons of accessibility.

In this case, the command `\renewcommand{\familydefault}{\sfdefault}` can be used to specify a sans-serif font as the base font. If you use `lualatex` for compilation and the `fontspec` package, you can also access all available fonts. If the Arial font is available on the computer, the command `\setsansfont{Arial}` can be used to

specify the Arial font as the sans serif font. The two lines in question can be found at the end of the `definitions.tex` file and only need to be commented out if required.

### 3.15 Metadata for the pdf Viewer

Some pdf viewers can display additional metadata, such as the name of the author, the title of the document (also different from the name of the file) or keywords. With the `hyperref` package, this metadata can be displayed with the command `\hypersetup{⟨settings⟩}`. Here, `⟨settings⟩` is a key-value list. The most important keys are `pdfauthor`, `pdftitle` and `pdfkeywords`. The meaning of these keys is self-explanatory

In addition, links in the document (when using the `hyperref` package) are highlighted as colored boxes in some pdf viewers. Of course, these colored boxes do not appear in the printed document. They only serve as an aid so that you do not have to move the cursor over the document randomly until you have found the link. If the colored boxes are annoying, you can deactivate them in `\hypersetup` with the `hidelinks` key.

### 3.16 Switch Between Single and Double-sided Layout

This template is optimized for a one-page layout. The left and right margins are the same size on all pages and new chapters start immediately on the next page. When the finished pdf document is viewed on the computer, it looks just right. However, if the document is to be printed double-sided, the layout can be adjusted slightly. Typically, the inner margins are then slightly narrower than the outer margins. New chapters always start on a new, right-hand page – which can lead to individual blank pages between the chapters. This looks better for double-sided documents.

To activate the double-page layout, it is sufficient to remove the commenting out of the `twoside` option in the optional argument of `\documentclass`.

### 3.17 Compile

Creating (compiling) large documents with L<sup>A</sup>T<sub>E</sub>X can take a relatively long time. As you usually only work on a few parts at a time, it can therefore be useful to comment out the remaining parts. This is particularly easy if you separate text into separate files and use the “`\input`” and/or “`\include`” command. This also keeps the main document clear.

Basically, the aim should be for your document to compile without warnings. The best thing to do is to regularly take care of rectifying any problems.

A typical warning is “*Reference ... undefined*”. It may disappear when you create it again, because only then will any new items be known. If this warning remains, the problem must be fixed, otherwise you will have question marks somewhere in the text.

Warnings relating to boxes that are too full are sometimes more difficult to understand and/or resolve. In **draft** mode (see section 3.18), the relevant places are marked precisely, which can be a great help. To avoid lines that are too long, it sometimes helps to mark separators (see section 3.4). Otherwise, a sentence may have to be minimally reworded.

The **draft** mode also has the advantage that compiling is faster (see above). Placeholders are inserted for images.

### 3.18 This Template

This template uses KOMA-Script, a “collection of classes and packages for L<sup>A</sup>T<sub>E</sub>X”<sup>1</sup>, which supports in particular the creation of German texts with the corresponding common typographical standards.

Creating documents with L<sup>A</sup>T<sub>E</sub>X is very similar to programming. An example: Wherever a paragraph is to be created, we have used the “**\par**” command in our “source code”. What exactly this command does is determined by its implementation. And this results from the **parskip** parameter of the document class, so to speak.

Other settings that can be made directly in the document class relate to, for example, the font size, the binding correction (BCOR) and the size of (**headings**). In principle, you can also influence the size of the margins with the **DIV** parameter, but this is not recommended. The margins are automatically set so that lines have a length that is easy to read.

After defining the document class, we have integrated some packages in the so-called Preamble, for example the **scrlayer-scrpage** package, with which we can define the appearance of the footer and header. This template has been set up so that the current chapter heading is always displayed at the top right of the current page (see **definitions.tex**).

---

<sup>1</sup><https://komascript.de>

Several packages are included in this template. The function of the most important of these is briefly explained below.

**fontspec** Allows free choice of font (but only works when compiled with `lualatex`)

**babel** Allows to select the default language and activates corresponding hyphenation patterns

**selnolig** Ensures that ligatures are automatically set correctly (but only works when using **fontspec** and thus also `lualatex`, automatically adopts the language setting of **babel**)

**microtype** Optimizes the appearance of the text (type area)

**csquotes** Ensures that quotation marks are automatically set correctly (automatically adopts the language setting of **babel**)

**tikz and pgfplots** This allows images to be generated directly in the source code, see section 3.6.2

**hyperref** Clickable links in the PDF

**biblatex** Improved references and bibliography

**amsmath und amssymb** Great expansion of the possibilities for displaying mathematical content

**listings** For the representation of source code, see section 3.10

**cleveref** Simplifies the insertion of references (see section 3.12)

**glossaries** Convenient creation of a list of abbreviations

## 4 Citations and References

Third party ideas must always be identified. Above all, they must be verifiable and findable. The technique of citing and referencing serves this purpose.

Different disciplines and degree programs follow specific citation conventions. Important information on common citation systems and styles can be found in the Writing Center's e-learning courses<sup>1</sup>.

### 4.1 Citations

Quotation marks at the bottom and top (“...”) are used to indicate text passages that have been copied verbatim.

If your quote already contains a quotation, you must replace the “double quotation marks” in the text with ‘single quotation marks’. See also section 3.13.

#### 4.1.1 References

A source reference must be created for all citations. The source reference is a short notation in the citation style which refers to the complete reference in the bibliography. References can be made *either* in the continuous text (Anglo-American citation style or Harvard style) *or* via a footnote at the bottom of the page *or* in an endnote at the end of the entire text. Different professional conventions apply here, which must be observed.

If you opt for short references in the text flow or for endnotes, the footnote area can be used for comments and for references to passages in your own text.

*Note the positions of the superscript and punctuation marks:*

If the literal quotation itself ends with a period, this is placed before the closing quotation mark. The superscript then follows directly afterwards without a space. A period is then omitted for the sentence itself.

---

<sup>1</sup>[https://ilu.th-koeln.de/goto.php?target=cat\\_52109&client\\_id=thkilu](https://ilu.th-koeln.de/goto.php?target=cat_52109&client_id=thkilu)

If the literal quotation does not end with a period, there are two cases: If the quotation is in the middle of your own sentence, the superscript follows directly after the quotation marks. If the quotation is at the end of your own sentence, first add the quotation marks, then your own period and only then the superscript.

To ensure that the source references remain unambiguous even if several short titles or year numbers of an author have the same name, the year numbers are given an additional small letter.

#### 4.1.2 Ibid

Today, word processing programs make referencing via *ibid* superfluous, as you are no longer forced to type out the same information repeatedly. . If you nevertheless decide to use this method (e.g. on the advice of your examiner), we strongly recommend that you only insert *ibid.* in the final editorial phase, as the references are only clear then.

#### 4.1.3 Secondary Quotations

Secondary quotations, are quotations from an author without having checked the original source for the context. Secondary citations are only permitted if the original source cannot be obtained. In the case of generally accessible scientific literature, secondary quotations should be avoided at all costs. If it is not possible to compare a quotation with the original text, then you should note cited by (followed by the source from which the quotation was taken) or cited in. This occurs, for example, when quoting facts from textbooks on the history of science.

#### 4.1.4 Citing Figures and Tables

The same guidelines apply here as for text quotations, i.e. there are also verbatim and modified reproductions. In the case of a verbatim reproduction, you can use an illustration e.g. in PowerPoint or a drawing/vector program. Copyright must be taken into account when scanning; this is only permitted if the author or publisher has granted permission – usually for a fee. In this case, the source reference must be made in the same way as for a literal quotation. For your own changes, an addition must be added to the source reference (e.g. *with minor changes*, *with own calculations*, etc.).

Because graphics are often copied, it is advisable to mark your own graphics or illustrations as such

In table and figure captions, the source is always given directly below the figure and not in a footnote or endnote. However, the source information does not belong in the list of figures and tables. See section 3.8.

## 4.2 Bibliography

The structure of the mandatory bibliography is explained below.

### 4.2.1 Content and Order of the Bibliography

In the bibliography, all publications used are listed in alphabetical order by author's name. The bibliography must include all sources cited in the text, but no additional sources. If works are published not only in printed form but also electronically, the bibliography should follow the printed version, unless the digital document has a fixed document number (DOI). If a letter abbreviation is used in the references in the text section instead of the title, this should also be indicated in the bibliography.

Several works published by one author within one year must be differentiated. For the short titles in the text, the years must therefore be distinguished by appending lower case letters. However, the year in the source citation remains unchanged without appended letters. The order of a, b, c etc. depends on the order of the source references. Whether first names are abbreviated or written out in full depends on the conventions of your subject. However, please remain consistent.

### 4.2.2 References in the Bibliography

The order in the notation of the bibliography depends on the document type and subject-specific conventions. It is therefore different for monographs than for journal articles, and again different in chemistry than in the humanities or mathematics. There are also no uniform standards for punctuation.

The data for a bibliography can be found on the title page of a book. This is not the book cover, but a printed sheet at the beginning of the book with the most important information identifying the work and book. First, the author or editor is named together with the title, followed by publication and printing information such as the publisher, place and year of publication. Although there is a DIN rule for title lettering, it is interpreted very differently.

In the e-learning courses of the Writing Center<sup>2</sup> you will find further information on the bibliographic information for different types of publications. The following bibliography is just one example of a possible format.

---

<sup>2</sup>[https://ilu.th-koeln.de/goto.php?target=cat\\_52109&client\\_id=thkilu](https://ilu.th-koeln.de/goto.php?target=cat_52109&client_id=thkilu)

## Bibliography

As explained in section 4.2.1, only the sources that are actually referenced in a paper are listed in the bibliography. Therefore, please always check the bibliography of your paper to ensure that all sources cited – and only these – have been included. This does not apply to the following list; most of the sources listed here are not cited in this template. This is merely an example of a bibliography with recommended reading for academic writing.

- [1] Volker Ahrens. *Abschlussarbeiten richtig gliedern in Naturwissenschaften, Technik und Wirtschaft*. 2nd edition. Zürich: vdf, 2018.
- [2] Doris Berger. *Wissenschaftliche Arbeiten in den Wirtschafts- und Sozialwissenschaften. Hilfreiche Tipps und praktische Beispiele*. Wiesbaden: Gabler, 2010.
- [3] Georg Bruhn and Gertrude Hirsch Hadorn. *Textanalyse in den Wissenschaften. Inhalte und Argumente analysieren und verstehen*. 4th, revised and updated edition. Zürich: vdf Hochschulverlag, 2021.
- [4] Uhrs Dahinden, Sabrina Sturzenegger, and Alessia Neuron. *Wissenschaftliches Arbeiten in der Kommunikationswissenschaft*. 2nd, corrected and updated edition. Bern: Haupt, 2014.
- [5] Donald E. Knuth. *The T<sub>E</sub>X Book*. Addison-Wesley Professional, 1986.
- [6] Hans Ebel and Claus Bliefert. *Bachelor-, Master- und Doktorarbeit. Anleitungen für den naturwissenschaftlich-technischen Nachwuchs*. 4th edition. Weinheim: Wiley-VCH, 2009.
- [7] Umberto Eco. *Wie man eine wissenschaftliche Abschlußarbeit schreibt*. 13th edition. Wien: facultas, 2010.
- [8] Helga Esselborn-Krumbiegel. *Von der Idee zum Text. Eine Anleitung zum wissenschaftlichen Schreiben*. 5th, updated edition. Paderborn: Schöningh, 2017.
- [9] Andrea Frank, Stefanie Haacke, and Swantje Lahm. *Schlüsselkompetenzen: Schreiben in Studium und Beruf*. Stuttgart, Weimar: Metzler, 2007.
- [10] Melanie Fröhlich, Christiane Henkel, and Anna Surmann. *Zusammen schreibt man weniger allein. (Gruppen-)Schreibprojekte gemeinsam meistern*. Opladen, Toronto: Budrich, 2017.

- [11] Karl-Heinz Göttert. *Kleine Schreibschule für Studierende*. 2nd edition. München: Fink, 2002.
- [12] Andreas Hirsch-Weber and Stefan Scherer. *Kleine Schreibschule für Studierende*. Stuttgart: Eugen Ulmer, 2016.
- [13] Matthias Karmasin and Rainer Ribing. *Die Gestaltung wissenschaftlicher Arbeiten. Ein Leitfaden für Facharbeit/VWA, Seminararbeiten, Bachelor-, Master-, Magister- und Diplomarbeiten sowie Dissertationen*. 10th, revised and updated edition. Wien: facultas, 2019.
- [14] Ulrike Kipman, Ulrike Leopold-Wildburger, and Thomas Reiter. *Wissenschaftliches Arbeiten 4.0. Vortragen und Verfassen leicht gemacht*. 3rd edition. Berlin: Springer, 2018.
- [15] Stefan Kottwitz. *LaTeX Graphics with TikZ*. Packt, 2023.
- [16] Bruno P. Kremer. *Vom Referat bis zur Abschlussarbeit. Naturwissenschaftliche Texte perfekt produzieren, präsentieren und publizieren*. 5th, updated and expanded edition. Berlin: Springer Spektrum, 2018.
- [17] Otto Kruse. *Lesen und Schreiben. Der richtige Umgang mit Texten im Studium*. 3rd, revised and expanded edition. Konstanz, München: UKV/Lucius, 2018.
- [18] Stefan Kühtz. *Wissenschaftlich formulieren. Tipps und Textbausteine für Studium und Schule*. 6th, updated and expanded edition. Paderborn: Schöningh, 2021.
- [19] Ulrike Lange. *Fachtexte lesen, verstehen, wiedergeben*. 2nd, revised edition. Paderborn: Schöningh, 2018.
- [20] Jürg Niederhauser and Dudenredaktion. *Die schriftliche Arbeit. Für Schule, Hochschule und Universität*. 3rd edition. Berlin: Dudenverlag, 2019.
- [21] Frank Norbert. *Handbuch Wissenschaftliches Schreiben. Eine Anleitung von A bis Z*. Paderborn: Schöningh, 2019.
- [22] Monika Oertner, Ilona St. John, and Gabriele Thelen. *Wissenschaftlich Schreiben. Ein Praxisbuch für Schreibtrainer und Studierende*. Paderborn: Schöningh, 2014.
- [23] Lydia Prexl. *Alles, was Ingenieur:innen über Deutsch wissen müssen*. München: UKV, 2021.
- [24] Lydia Prexl. *Mit digitalen Quellen arbeiten. Richtig zitieren aus Datenbanken, E-Books, YouTube und Co.* 3rd updated and revised edition. Paderborn: Schöningh, 2019.
- [25] Jan Schaller. *Papierlos studieren. Wissenschaftlich arbeiten in digitalen Zeiten*. Opladen, Toronto: Budrich, 2020.
- [26] Ulrike Scheuermann. *Schreibdenken. Schreiben als Denk- und Lernwerkzeug nutzen und vermitteln*. 3rd, revised edition. Opladen, Toronto: Budrich, 2016.

- [27] Kirsten Schindler. *Klausur, Protokoll, Essay. Kleine Texte optimal verfassen*. 3rd, revised edition. Paderborn u. a.: Schöningh, 2011.
- [28] Mona Stier. “Jenseits der Hausarbeit: Die vielen kleinen Textsorten des Hochschulalltags.” In: *JoSch. Journal der Schreibberatung* 9 (2015), pp. 82–87.
- [29] Rüdiger Voss. *Wissenschaftliches Arbeiten ... leicht verständlich*. 8th, revised and expanded edition. München: UKV, 2022.
- [30] Judith Wolfsberger. *Frei geschrieben. Mut, Freiheit & Strategie für wissenschaftliche Abschlussarbeiten*. 4th, edited edition. Wien, Köln, Weimer: Böhlau Verlag, 2016.
- [31] Christian Wymann. *Der Schreibzeitplan: Zeitmanagement für Schreibende*. 2nd, revised edition. Opladen, Berlin, Toronto: Budrich, 2021.

## **Appendix**

## Declaration

I declare that I have written this thesis independently. I have acknowledged all passages taken verbatim or in spirit from published or unpublished works of others or from the author himself/herself. All sources and aids that I have used for the thesis are indicated. The thesis has not been submitted to any other examination authority with the same content or in essential parts.

**Note: In some degree programs, the declaration can be found directly after the cover sheet of the thesis.**

---

Place, date

---

Signature