Template

Bachelor’s / Master’s Thesis

Version 2020

In the template, replace the red passages with appropriate data or delete them.

Cover

Instead of this page, use your personalized cover generated by the BUT information system.

Title Page

Instead of this page, use your personalized titlepage generated by the BUT information system.

Assignment

Instead of this page, use your personalized assignment generated by the BUT information system.

* insert the original assignment with the signature of council chairman into the printed version of the final thesis
* insert a copy of the assignment without a signature into the electronic version

Abstract

An abstract in the English language (replace this section with your own text).

Generally, an abstract contains reduced characteristics of the document; thus, it does not comprise information relating to the authors, supplementary data, or individual evaluation of the thesis (namely, sentences such as “*In this thesis, I describe in an effective way a system that I consider interesting*” should be shortened and made neutral to read “*The thesis describes a system*”. The actual text is expected to be concise, clear, accurate, objective, easy to read, and formulated naturally in written sentences. Although the author may use phrases or passages from his or her own term papers and/or theses, these together must form a new whole. A standard abstract is 5 to 10 lines long, with 50 to 100 words not exceeding 1,000 characters.

Keywords

Relevant keywords in the English language (replace this section with your own text). This part of the thesis specifies the most significant words or phrases that, within the limits of the natural language, allow the thesis to be suitably classified, searched, and identified. The keywords should match relevant entries in the thesaurus of the given discipline and are expected to characterize the problem discussed in the author’s term paper(s) and/or theses. The keywords should be ordered logically, in a hierarchical manner or according to the contents of the thesis. In terms of quantity, 5 - 8 keywords are considered standard.

Abstrakt

Ekvivalentní text abstraktu v českém jazyce (odstavec nahraďte svým textem).

Klíčová slova

Ekvivalentní klíčová slova v českém jazyce (odstavec nahraďte svým textem).

Rozšířený abstrakt

Extended abstracts must contain all relevant aspects and information of the thesis.

Bibliographic citation

NOVAK, J. *Title of Thesis*. Brno: Brno University of Technology, Faculty of electrical engineering and communicacations, Dept. of telecommunications, 2020. 11 p., 3 p. of attachments. Bachelor’s thesis/Master’s thesis. Advised by Prof. Jiří Novotný.

Note: Bibliographic citation is generated by BUT information system.

Declaration

* Include the original declaration signed by the author in the printed version of the final thesis
* Insert an unsigned copy of the declaration into the electronic version

Author’s Declaration

**Author:** *Author´s name and surname*

**Author’s ID:** *Author´s BUT ID |*

**Paper type:** *Bachelor’s / Master’s Thesis*

**Academic year:** *2020/21*

**Topic:** *Title od final thesis*

I declare that I have written this paper independently, under the guidance of the advisor and using exclusively the technical references and other sources of information cited in the project and listed in the comprehensive bibliography at the end of the project.

As the author I furthermore declare that, with respect to the creation of this paper, I have not infringed any copyright or violated anyone’s personal and/or ownership rights. In this context, I am fully aware of the consequences of breaking Regulation S 11 of the Copyright Act No. 121/2000 Coll. of the Czech Republic, as amended, and of any breach of rights related to intellectual property or introduced within amendments to relevant Acts such as the Intellectual Property Act or the Criminal Code, Act No. 40/2009 Coll., Section 2, Head VI, Part 4.

.

Brno, December 18, 2020

 author’s signature

Acknowledgement (optional)

You can formulate your own acknowledgment to those who helped you with your work (supervisor, consultant, colleague, ...). Insert the original, signed acknowledgment into the printed version of the final thesis; an unsigned acknowledgment is included in the electronic version.

Example:

I would like to thank my supervisor ………. for his invaluable advice and support.

Brno, December 18, 2020

 author’s signature

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*Note: The content within this template is automatically generated from headings at level 1 to 4. To update, right-click on the created contents and select* ***Update field 🡪 Entire table****.*

Symbols and abbreviations

Abbreviations:

FEEC Faculty of Electrical Engineering and Communications

BUT Brno University of Technology

Symbols:

*U* voltage [V]

*I* current [A]

Note: This section should list all abbreviations used in the text and all symbols used in the equations.

Figures

[2.1 Inserting link to a figure. Select *Link Type*, then *Label* and *Number Only* 16](#_Toc57122518)

Note: The list of figures within this template is automatically generated from the inserted captions. To update, right-click on the list and select **Update field 🡪 Entire table**. All items formatted with this style are added to the list.

If the thesis does not contain pictures, delete this chapter.

Tables

2.1 The following important styles are defined in this template 16

Note: The list of tables within this template is automatically generated from the inserted captions. To update, right-click on the list and select **Update field 🡪 Entire table**. All items formatted with this style are added to the list.

If the thesis does not contain tables, delete this chapter.

Introduction

(Replace the chapter with your own text.) This document embodies a guide on how to formally prepare a thesis. At the same time, the document can be used as a template for writing your own work. The red text needs to be replaced with your data. The resulting text must be black.

The unnumbered *Introduction* chapter presents issues relating to term papers and Bachelor's or Master's theses. Typically, it states: (a) what thematic area the work falls into, (b) what the main objectives of the work are, and (c) how they were achieved. The *Introduction* chapter usually does not exceed one page. By default, the last paragraph in therein indicates the basic structure of the entire document, like the following text.

The template of the final thesis is divided into four basic parts. Chapter 1 outlines the structure and necessary requirements of each final thesis. The basic styles for working with text are introduced in chapter 2. Some important typographic principles are then given in chapter 3, and chapter 4 is a brief summary of the entire document.

# THESES STRUCTURE

(Replace the chapter with your own text.) The following text presents the structure of a term paper or a final thesis. In addition to the project documentation itself, it also contains several formal sections that must be observed.

## Compulsory parts of the thesis

Each Bachelor's /Masters’s thesis must contain a title page, original assignment (or a copy of the assignment without signature in electronic version), a brief abstract, keywords in Czech and English, an exact citation of the thesis, and a signed declaration of independent work on the project. Acknowledgments are optional. The following is the content of the whole work, which can be supplemented by a list of figures and tables. The actual text of the project follows.

The text of the thesis must be written in the passive voice and in a technical style. It is necessary to use formulations such as "the program was written"or "the size of the resistance was chosen", not "the program I wrote" or "the size of the resistance I chose". Statements in the 1st person singular or plural and slang/colloquial expressions should be avoided completely.

At the end of the work, the author must provide a list of all sources that he or she used in writing the thesis. Individual sources must be cited according to the standard; we recommend that online citation tools be utilized, see [1]; some other sources of information are listed here. It should be emphasized here that the title of a book, the title of a proceedings, or the title of a journal is always in italics in the bibliography. The order of the literature used in its list must correspond to either: (a) the order of use and occurrence in the text or (b) the alphabetical order according to the first author. Variants (a) or (b) are chosen by the author.

In the text of the final thesis, it is necessary to refer to the sources mentioned. Attention: stating an image, procedure, or formula taken without a cited source is considered plagiarism and may render the thesis unfit for defense! The text may be literally rewritten/copied only to the extent necessary and in specially justified cases (citations of laws, definitions, etc.), always with an indication of the primary source.

## Structure of the work

The final thesis can be divided into several basic parts:

* **Introduction** - introduces the reader to the problem. The recommended extent is about 1 page.
* **Theory**/**literary research** - one or more chapters discussing the theory that was employed in solving the given problem.
* **Own problem solving** - the most important part of the final work, focused on the individual solution of the assignment and thus on the solver's own work. This section contains, for example, the results of measurements, calculations, and their evaluation. Described procedures used.
* **Conclusion** - summary of the achieved results, used methods, and proposal of further continuation in solving the given problem.

## Electronic attachment

An integral part of the semestral or final thesis is an electronic attachment inserted in the form of a ZIP or PDF file into the information system of BUT. If the aim of the work was to create a hardware device or a service software, the electronic attachment must contain all materials for production (e.g., PCB design files in Eagle) or for program compilation (all source files, compiler settings, etc.). It is advisable to save here all graphic files (images in suitable resolution or in vector format) inserted into the text of the final work.

# Basic work with styles

(Replace the chapter with your own text.) This chapter introduces the basic rules that should be followed when writing a semestral/final thesis. It is mainly about using styles that simplify the formatting of the work and also ensure its uniformity.

## Text segmentation

The text of the thesis is divided into chapters and subchapters of several levels, while decimal numbering is used at individual levels (e.g. 2, 2.1, 2.1.1). Do not use deeper headings than three levels. Each level 1 chapter must start on a new page. The prepared numbered styles in the template are named **Title 1**, **Title 2**, and **Title 3**. Use these styles to automatically generate content and number it correctly at the same time.

It is also possible to use chapter names in the work, which usually do not contain numbering. These are, for example, a list of figures, a list of tables, literature, etc. These names can be created using the **Title 1 - unnumbered** style.

Chapters and subchapters are like the appendices and their styles **Appendix 1** and **Appendix 2**. These styles define different numbering of appendices, where it is customary to use letters instead of numbers and are also used to automatically create a list of appendices. An example of the use of appendices is given at the end of the work.

Insert references to figures, tables, literature, formulas, and chapters in the text as so-called cross-references (menu *Reference 🡪 Cross-reference*); it is automatically updated depending on changes in the text. For example, here is a link to the chapter 1, and literature [3]

## Style for text

### Normal style

The first line of text following the chapter title is not indented and uses style **First paragraph**.

All other paragraphs in the text are indented by the first line and are formed by the **Paragraph** style. The indentation of the first line together with the small space between the paragraphs helps the reader in easier orientation in the text. This style uses a 12 pt Times New Roman serif font, simple line spacing, and all text is aligned to the block.

### Source code

A special case of text is a sample source code.

A non-proportional font, such as Courier New or Consolas, and a smaller font size are used to such code. The predefined style is called **Source Code**. In the source code, it is useful to highlight the syntax, or at least the reserved words of the programming language, as the following example shows. **ATTENTION: Insert source code snippets into the text only if this will improve your understanding of the issue.** Individual codes should not be longer than half an A4 page. In many cases, the use of a text or graphical notation algorithm is more illustrative (e.g. free software Dia Diagram Editor, yEd Graph Editor).

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\* Main function

\*/

**int** main(**void**)

{

// setup I/O port

 DDRB = 0xff; // set output direction

 PORTB = 255; // turn off all LEDs

// forever loop

 **while** (1){

 delay\_ms(100); // wait for 100 ms

 PORTB = PORTB-1; // change binary counter

 }

 **return** 0;

}

## Inserting pictures

Figures inserted into the text are intended to help with the understanding of the described issues. It must be of sufficient quality, either vector or bitmap with a higher resolution (at least 300 dpi), it can be black and white or color. **Do not use scanned figures - these can only be accepted in justified cases and always with the appropriate citation of the source.**

Each figure must have a caption that contains its number, name, and is located below the figure. There is no dot after the descriptive text. The style for the figure caption format is called **Label**. Due to the imperfection of Word, it is necessary to insert figures and their captions in the form of tables (without borders) to create links in the text by inserting only numbers (without captions). Therefore, for other images, copy the table in Figure 2.1 and replace the image and description in it. The numbering is updated automatically before printing or manually via the local menu (right mouse button *🡪 Update field*).

When inserting a reference to a figure (and similarly for tables and equations), choose the *Reference 🡪 Cross Reference* menu and select the appropriate *Reference Type*, then choose *Label and Number Only*.

|  |
| --- |
|  |
| Fig. | 2.1 Inserting link to a figure. Select *Link Type*, then *Label* and *Number Only* |

## Inserting tables

The tables have a similar meaning as the figures, ie their purpose is to help with the understanding of the described issues. **Under no circumstances should you insert tables as bitmaps or even scan them.** For tables, they must also be referred to in the text. Again, a label is used for this, which, unlike the image, is inserted before the table itself. The label style is the same as in the previous section - **Label**. The insertion procedure is also similar - copy the label before table 2.1 (it is a one-row table without borders) and replace the description in it.

The **Table** style is used for text inside a table. Table 2.1 contains a list of all defined styles that can be used to create a semestral / final thesis.

|  |  |
| --- | --- |
| Table | 2.1 The following important styles are defined in this template |

|  |  |  |
| --- | --- | --- |
| Style name | Use | Example |
| Title 1 | Title level 1 | **1. Title 1** |
| Title 2 | Title level 2 | **1.1 Title 2** |
| Title 3 | Title level 3 | **1.1.1 Title 3** |
| Title 1 - unnumbered | Title unnumbered | **Title unnumbered** |
| Title no contents | Title - does not appear in the contents | **Title no contents** |
| Literature | Style for writing used literature | [1] Literature |
| Appendix 1 | Appendix title | Appendix A |
| Appendix 2 | Appendix subtitle | Appendix A.1 |
| First paragraph | Writing normal text first paragraph (not indented) | Normal text |
| Paragraph | Writing normal text in paragraphs (indented)) | Normal text |
| Source code | For listing source texts | Source code |
| Label | For captions of figures and tables | Label |
| Table | For texts in tables | Table |

## Inserting equations

We can use the integrated Equation Editor to create equations. The equations are inserted on a separate line and are numbered. Their number is given in parentheses (on the right side of the page) and is used for easy links in the text. The equation is easier to manage by copying the entire table with the equation (it's a single-row table without a border) and replacing the equation in it. Then add parentheses to the number and format using the **Equation** style.

Each equation is part of a sentence, so it must be included in it, including punctuation marks, as the following example shows.

A one-dimensional discrete cosine transform is defined by the relation

|  |  |
| --- | --- |
| $F\left(u\right)=γ\left(u\right)+\sum\_{x=0}^{N-1}f\left(x\right)cos\frac{πu\left(2x+1\right)}{2N}$ , | (2.1) |

where *f*(*x*) represents the signal in the time domain, *F*(*u*) is its transformed image, *γ*(*u*) represents the weighting coefficient, the index u takes values from 0 to *N*-1 and the constant *N* determines the number of points of the input signal.

The rule is that the variables in the text of the equation and the text of the work itself are always given in italics and the constant quantities are always in capital letters. The indices for all quantities are also given in block letters.

# Typographical and language principles

(Replace the chapter with your text.) When printing technical text of the technical report type, which includes, for example, the text of qualification theses, the A4 format is often selected and often only printed on one side of the paper. In this case, choose the left margin of all pages slightly larger than the right - this is where the paper will be bound and the binding technology will force this requirement.

Choose the top and bottom margins the same size, or move the printed portion slightly up (top edge smaller than bottom). Note that the edges will be cut off when binding.

For typesetting on an A4 page, it is advisable to use a 12-point font (size) for the basic text. Choose a width of 15 to 16 cm and a height of 22 to 24 cm (including any headers and feet). The line spacing is chosen to be 120 % of the degree of the base font used, which is the optimal value for the speed of reading continuous text.

When inserting images, choose their dimensions so that they do not exceed the area in which the text is printed (ie the edges of the text on all sides). Set aside a separate page for large images. Place pictures or tables larger than A4 in a written report in the form of a jigsaw puzzle sewn into an attachment or pasted into tabs on the back cover.

Figures and tables must be numbered sequentially. The numbering is chosen either continuously throughout the text or - which is more practical and is used in this template - continuous within the chapter. In the second case, the table or figure number consists of the chapter number and the figure / table number within the chapter - the numbers are separated by a dot. Subchapter numbers have no effect on the numbering of figures and tables. Tables and figures use their own independent number series. It follows that in the links inside the text, in addition to the number, we must also provide information on whether it is a picture or a table (for example, "... see table 2.7 ...").

The equations to which we will refer in the text are given serial numbers at the right edge of the relevant line. These serial numbers are written in parentheses. The numbering of equations can be continuous in the text or in individual chapters.

For links to pages, chapter and subchapter numbers, figure and table numbers, and other similar examples, we use cross-references to ensure that the correct number is generated even if the text shifts due to changes in the text itself or by adjusting the rate parameters.

The punctuation marks are a dot, comma, semicolon, colon, question mark, and exclamation point, as well as closing parentheses and quotation marks that enclose the previous word without a space. The gap is made behind them. However, this does not apply to the decimal point (or decimal point). The opening parenthesis and front quotation marks are attached to the next word, and the space is left before them - (this way) and "this way." The slash is written without spaces. For example, the school year 2001/2002.

Typographical transgressions are also the so-called widows and orphans - isolated lines at the beginning or end of a paragraph, which are separated from the rest of the paragraph by a page break.

One-letter prepositions and conjunctions such as u, k, o, s, v, z, and, i are never left alone at the end of a line. It is necessary to use a so-called fixed space after them, which you type using the keyboard shortcut Alt + 0160 or the combination Ctrl + Shift + space. A fixed space looks like a classic space, but a line break cannot occur at that location. This type of space must also be used in abbreviations or codes (for example: "Inc"), The combination of the abbreviation of the first name and surname or the abbreviation of the title and surname ("J. Malá", "JUDr. Novák").

## It will never be absolutely perfect

Once we've written everything we've been thinking about, we'll take a day or two off and then we read the manuscript ourselves again. We will make the last adjustments and finish. We are aware that something is always left unfinished, there is always a better way to explain something, but each stage of adjustment must be final.

## What is a standardized page?

The term standardized page refers to the assessment of the volume of work, not to the number of sheets printed. Historically, this is the number of pages of a manuscript written by a typewriter on special pre-printed forms while maintaining the average line length 60 characters and 30 lines per manuscript page. Due to the notation of correction marks, line spacing 2 (both one line) was used. This data (number of characters per line, number of lines and line spacing) does not relate to the final printed result. They are used only for range assessment. One standard page therefore means 60 × 30 = 1800 characters. Figures included in the text are included in the scope of the written work by estimating the amount of text that would print an equally large area in the resulting document.

The approximate scope of work in standard pages can be determined in Microsoft Word using the **Number of words** function in the *Tools menu* by dividing the value of *Characters (including spaces)* by the constant 1800. Only the text specified in the core of the work is included in the scope of work. Parts such as abstract, keywords, statements, content, literature or appendices do not count towards the scope of the work. It is therefore necessary to first mark the core of the work and only then have the number of characters counted. You can estimate the approximate range of images manually.

# conclusion

(Replace the chapter with your text.) The conclusion provides a brief summary of what has been achieved. The recommended range is on one side. The reader should learn about all the results, but also about the points that were not performed / measured. The conclusion should include a critical analysis of the results achieved and a description of the benefits of the bachelor's or master's thesis. Finally, a summary of technical parameters or specific results of design, implementation or simulation can be given. A part of the final chapter can also be a proposal for further work in the given issue (for the semestral work this is compulsory).

Literature

1. *Portál Citace.com* [online]. 2014 [cit. 2020-11-18]. Available from: www.citace.com HLAVSA, Zdeněk. *Pravidla českého pravopisu*. Vydání 3. Praha: Academia, 2017. ISBN 978-80-200-2755-9.
2. *Směrnice č. 72/2017 Úprava, odevzdávání a zveřejňování závěrečných prací.* *VUT v Brně* [online]. Brno: VUT v Brně, 25.3.2019 [cit. 2020-11-10]. Available from: https://www.vutbr.cz/uredni-deska/vnitrni-predpisy-a-dokumenty/smernice-72-2017-uprava-odevzdavani-a-zverejnovani-zaverecnych-praci-d161410
3. *ČSN ISO 690: Informace a dokumentace - Pravidla pro bibliografické odkazy a citace informačních zdrojů*. Praha: Úřad pro technickou normalizaci, metrologii a státní zkušebnictví, 2011.
4. *ČSN ISO 7144: Dokumentace - Formální úprava disertací a podobných dokumentů*. Praha: Úřad pro technickou normalizaci, metrologii a státní zkušebnictví, 1997.
5. *ČSN EN ISO 80000-2: Veličiny a jednotky - Část 2: Matematické znaky a značky užívané v přírodních vědách a technice*. Praha: Úřad pro technickou normalizaci, metrologii a státní zkušebnictví, 2020.

Note.: To create citations in the format according to ČSN ISO 690, it is recommended to use the website: http://www.citace.com/

List of appendices

[Appendix A - Measured values 23](#_Toc56778043)

The part of the appendices itself consists of two parts "List of appendices" and individual appendices marked "Appendix A", " Appendix B" to " Appendix X". For example, manuals, source codes, extensive tables with measured values, graphs, are added to the appendices. If such data are not part of the work, it is not necessary to state the chapters at all.

If the scope of the appendix is too large (e.g. too many tables or many pages of source code), the list of appendices can include the sentence: " Appendix A - The source code of the program is stored on the enclosed CD". In this case, the final thesis must be accompanied by a CD on which the relevant data are stored and clearly marked.

1. Measured values
	1. Table of measured values

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Rz (W)** | **Iz (A)** | **Uz (V)** | **Pi (W)** | **Pz (W)** | **P (W)** | **h** |
| 10 | 4,000 | 40,00 | 320,00 | 160,00 | 480,00 | 33,33% |
| 15 | 3,429 | 51,43 | 235,10 | 176,33 | 411,43 | 42,86% |
| 20 | 3,000 | 60,00 | 180,00 | 180,00 | 360,00 | 50,00% |
| 25 | 2,667 | 66,67 | 142,22 | 177,78 | 320,00 | 55,56% |
| 40 | 2,000 | 80,00 | 80,00 | 160,00 | 240,00 | 66,67% |

* 1. Graphs of measured values