

# **Design, fabrication, and performance analysis of solar thermal water heater using phase change material**

By

John Smith



A thesis submitted in conformity with the requirements for the degree of

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Faculty of Engineering (Mechanical)

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PIET, Multan

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# Committee

The members of the Committee approve the thesis of John Smith defended on date

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Engr. XYZ  
thesis Supervisor

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Asst. Prof. XYZ  
Committee Member

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Asst. Prof. Dr. Muhammad Sana  
Ullah Sahar  
Committee Member

Approved:

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Den's name, Dean, College of Faculty of Engineering (Mechanical)

# Abstract

Dissertations/theses or projects must have an abstract that provides a concise summary of the student's work submitted in partial fulfillment of an intended degree. The aim of the abstract is to inform readers about the content of the dissertation/thesis/project. While the abstract content may change between disciplines, it usually includes a brief description of the research motivation, method, results and conclusions. The abstract should not include subheadings, citations, tables or figures. The abstract should follow the Committee page and has the heading ABSTRACT at the top, center. The abstract page number should start on page iii. The length of the abstract should not exceed one page. Please refer to the typing specifications in Chapter 1.

# Table of contents

<b>List of tables</b>	<b>vi</b>
<b>List of figures</b>	<b>vii</b>
<b>Acknowledgements</b>	<b>viii</b>
<b>Dedication</b>	<b>ix</b>
<b>1 Title of chapter</b>	<b>1</b>
1.1 Introduction . . . . .	1
1.2 Typing Specifications . . . . .	1
1.3 Margins . . . . .	2
1.4 Front Matter . . . . .	2
1.4.1 Title Page . . . . .	2
1.4.2 Abstract . . . . .	3
1.4.3 Table of Contents . . . . .	3
1.4.4 List of Tables and List of Figures . . . . .	3
1.4.5 Acknowledgments . . . . .	4
1.4.6 Dedication . . . . .	4
1.5 Main text . . . . .	4
1.6 Back Matter . . . . .	5
<b>2 TITLE OF CHAPTER</b>	<b>6</b>
2.1 Page Numbering . . . . .	6
2.2 Figures and Tables . . . . .	6
2.3 Heading levels . . . . .	8
<b>3 COPYRIGHT AND ETHICAL ISSUES</b>	<b>9</b>
3.1 Similarity Index . . . . .	9
3.2 IRB/IACUC . . . . .	9
3.3 Copyright . . . . .	9
<b>References</b>	<b>11</b>

<b>Appendices</b>	<b>11</b>
<b>A Additional information here</b>	<b>12</b>
A.1 Introduction . . . . .	12
<b>B More additional information here</b>	<b>13</b>
B.1 Introduction . . . . .	13
B.2 Conclusion . . . . .	14

# List of Tables

2.1	This is an Example of an APA Table . . . . .	7
-----	--	---

# List of Figures

2.1	Caption of figure . . . . .	7
-----	-----------------------------	---

# Acknowledgements

I would like to take this opportunity to thank all the people without whom this study would never have been possible. Although it is just my name on the cover, it has been a collaborative effort from researchers from xxxxx

For my supervisors, you have encouraged and provided me with the opportunity to enrol into the doctoral programme after my last studies nearly twenty years ago. It has not been easy for my family, leaving our extended families and my career behind. I much appreciate your guidance and support you offered when needed and continuously pushing me to make this piece of work better. xx thank you for being an incredibly valuable part of my unusual journey of mine and giving me encouragement and support, especially during the critical first year of my xx.



# Dedication

I, name, declare that this thesis titled, xxxxx and the work presented in it are my own and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

xxxxx, August 2020

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Name

# **Chapter 1**

## **TITLE OF CHAPTER**

### **1.1. Introduction**

It is the responsibility of student to ensure consistent formatting throughout the dissertation, thesis or project submitted to fulfill a degree requirement. Accepting the formatted document by the University is a graduation requirement. A student who fails to comply with the required formatting may not graduate until he/she receives a final approval for the submitted document. The purpose of this guide is to provide students with specific instructions to facilitate adherence to consistent formatting.

### **1.2. Typing Specifications**

The text format should be double-spaced throughout the whole document. Single spacing, however, may be used for long quotations, footnotes, and tables and figures captions. Students must leave one double-spaced line between the end of a paragraph and the start of a table or a figure. Students should leave one double-spaced line before the start of subsequent paragraph or section. Use a standard 12-point font size. Student's may use larger font size but no larger than 16-point for the title of the Dissertation/Thesis/Project and for chapter headings. Smaller font size but no less than 9-point, and must be legible, may be used in tables and figures.

Boldface type may be only used for headings. Chapters must begin on a new page. Unless you have room for at least couple of lines following a heading, you must avoid starting a heading at the bottom of a page.

## **1.3. Margins**

Use a 1.5” on the left side and 1” all other sides.

## **1.4. Front Matter**

Front matter refers to the pages that appear before the main text of the dissertation/thesis/project.

The front matter consists of:

- Title page
- Committee Page
- Abstract (required for all dissertations/thesis and project and begins on page iii)
- Table of Contents
- List of Tables
- List of Figures
- Abbreviations, nomenclature, maps, multimedia items, etc.
- Preface (optional: not common, but some disciplines may require it)
- Acknowledgments
- Dedication (optional)

### **1.4.1 Title Page**

Students must adhere to the format of title page as provided in the samples. The title of the dissertation/thesis/project must be in capital letters. The title can run for more than one line, make sure to use double-spacing. Avoid using non-alphabetical symbols, Greek letters, formulas subscripts and superscripts in the title. Make sure that you have name written as it appears in your University Records. Use the month and year of degree conferral on the title

page. At HBKU the degree conferral date is in April . Do not use the date of the defense or the document submission date. The copyright for the dissertation/thesis/project is owned by the student. On the copyright line, use the symbol ©, followed by the degree conferral year and your name. Following your name include All Rights Reserved.

### **1.4.2 Abstract**

Please refer to the instruction under the Abstract.

### **1.4.3 Table of Contents**

The table of content is to compile all of the headings presented in the text. It must follow the Abstract in the document. It should include a listing of all headings after the table of content, including the List of Tables, the List of Figures. The listing in the table of content must match exactly the headings as they appear in the document and in the same page as they appear in the text. If you use appendices make sure the title for each appendix appears in the table of contents. The table of content should be double-spaced.

### **1.4.4 List of Tables and List of Figures**

The list of Tables and the List of figures include the captions and the page numbers of every table and figure in the dissertation/thesis/project. In the text the figure caption appears under the figure, while the table caption appears above the table. The captions should be aligned left.

Depending on your discipline and or the nature of your dissertation/thesis/project and if you are using abbreviations and or nomenclature in the main text, you may have to pages for each of these following the list of figures page. The list of tables, the list of figures, etc. should be double-spaced.

## 1.4.5 Acknowledgments

This section is for students to declare all necessary acknowledgement for all who provided assistance for you to complete the dissertation/thesis/project including but not limited to family members, faculty, staff, technicians, colleagues and any financial support from any source, etc.

If your program requires a preface, make sure that it comes before the acknowledgements section.

## 1.4.6 Dedication

Students may select to dedicate the dissertation to a person or a group.

### *1.4.6.1 Dedication*

Subsection title.

## 1.5. Main text

Different disciplines may have different entries. You will need to consult with your advisor on the specific components to include. Some of the components may include some or all of the following:

- **Introduction:** In here students summarizes the state-of-the-art as it relates to the research domain as presented in literature, identifies the research problem without any ambiguity and establishes the rational and objectives of the research. The introduction should articulate to the reader what to expect in the rest of the document.
- **Background:** Comprehensive literature review of relevant literature that accounts for how others addressed the problem and identification of shortcomings in the reported work and how this dissertation/thesis/project will bridge the gap.
- **Approach:** The document should describe the research approach and research methods used and why these were selected and how they apply to the research.

- **Research Findings:** This component presents the results of the research with adequate data. The data and verification should be presented with adequate explanation.
- **Discussion:** An exhaustive scholarly discussion on the finding should be provided. It should provide details on the contribution of the work to current knowledge and how it differs from existing results.
- **Conclusion:** Summarizes the dissertation/thesis/project and restate the major findings.

## 1.6. Back Matter

The back matter or end matter of the dissertation/thesis/project includes:

- **References or bibliography:** All dissertations/theses/projects must include reference sections that list all the works which referred to in the text. There are many scholarly styles for reporting the references. Consult with your advisor on the style used in your discipline before compiling this section. You may find a good reference for the different styles at (<https://owl.english.purdue.edu/owl/section/2/>). It is mandatory that you use one style in the entire document and for compiling this section. If no preferred style is identified use the APA (American Psychological Association). Some programs request students to use EndNote, which provides a useful tool to have the references arranged in different styles. References should be double-spaced (Adrian, 1926).
- **Appendices:** Appendices typically contain material that is pertinent to the main text. Appendices are arranged in either alphabetical (Appendix A, Appendix B, etc.) or numeral order (Appendix 1, Appendix 2, etc.) or (Appendix I, Appendix II, etc. If only one appendix, just call it Appendix without any numbering. Titles of the Appendices should appear in the Table of Content.

## **Chapter 2**

# **TITLE OF CHAPTER**

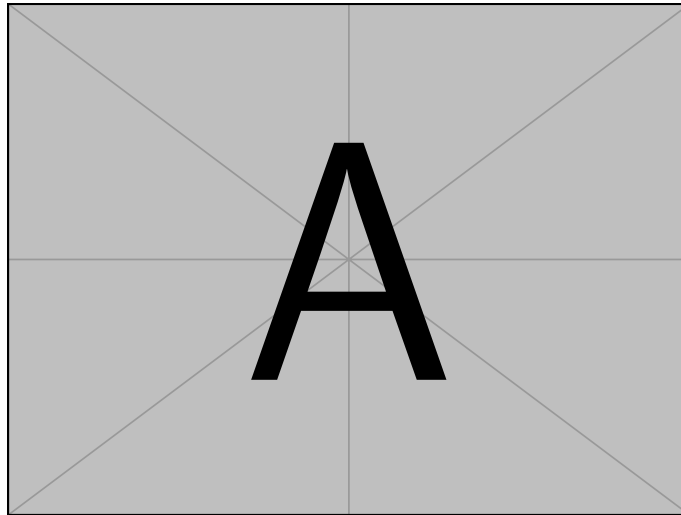
### **2.1. Page Numbering**

Except for the title page, all pages in the document must have a page number. The front matter starting from the Committee page should have lower case Roman numerals. Start with the Committee page as page number “ii”. The main text and the back matter should use Arabic numbers. Page numbers must be placed in the lower right-hand corner of the page. Make sure that you do not:

- skip numbers
- use different numbering schemes
- use the word “page” before the number
- run the text/figure/table to overlap with the page number
- use dashes (e.g. -1-) or words

### **2.2. Figures and Tables**

Use your discipline preferred style guide (APA, MLA, IEEE, AMA, etc.) as approved by your program to format tables and figures. Each table and each figure in the text must have a number and a caption. You may number them consecutively starting with 1 (e.g. Figure 1: Illustration of . . .) or by chapter using decimal numbering (Figure 2.1: Illustration of . . .). Table captions appear on top of the table and figures caption appear at the bottom of the figure. Captions are aligned left.



**Figure 2.1:** Caption of figure

Table 2.1 shows a sample format using the APA style. The fonts size and font type should be consistent with the main text.

**Table 2.1:** This is an Example of an APA Table

Programs	Total for 2014	Total for 2016
Master's	4	12
PhD	0	6

Each figure and each table must be referenced, by the figure or the table number, in the text. Do not use phrases such as “The figure below or the Table above or the following figure, etc.). The figures and tables are placed after the paragraph where it was first mentioned, preferably on the same page if the available space allows. If you have oversized figures and tables that do not fit in the page even when you relax the margins, you may:

1. **Use landscape pages:** Place the figure or table using landscape style on the page. Make sure you still use the same page numbering scheme.
2. **Reduce type size:** Reduce the font size of the figure or table, but make sure that you do not lower the size below 9-point.
3. **Rotate the figure or table:** Rotate the figure or table and the caption or heading counterclockwise so that all components can be read together. The page number needs to be rotated with the figure.



## 2.3. Heading levels

The following heading levels are required:

Heading 1: Flushed left, Boldface, UPPERCASE HEADING

Heading 2: Flushed left, Boldface, Uppercase and Lowercase

Heading 3: Flushed left, Boldface, *Uppercase and Lowercase*

Heading 4: Flushed left, *Uppercase and Lowercase*

*Heading 5 and higher use the same style as heading 4.*

## **Chapter 3**

# **COPYRIGHT AND ETHICAL ISSUES**

### **3.1. Similarity Index**

The responsibility relies on the student to ensure the scientific integrity of the document. Students must ensure that all published material copied in the document has the appropriate copyright permissions to reproduce and appear in the appendix. The student should analyze the document with appropriate plagiarism software. The results need to be evaluated by the student's advisor. Students who violate the honor code will be subjected to appropriate disciplinary action as stipulated by the University Policy.

### **3.2. IRB/IACUC**

If the research work deals with human subjects, the document should clearly demonstrate that an Institutional Review Board (IRB) approval has been obtained. If the research involves animals, the document should clearly demonstrate that an approval from the Animal Care and Use Committee has been obtained. Approval document must be submitted with the dissertation/thesis/project during the final format review.

Research involves the use of biohazard or environmentally material will require approval by the appropriate committee. Approval document must be submitted with the dissertation/thesis/project during the final format review.

### **3.3. Copyright**

HBKU recognizes that the dissertation, thesis or project is the property of the being the primary and sole author of the dissertation, a thesis or a project, however the student must grant

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## **Appendix A**

# **ADDITIONAL INFORMATION HERE**

### **A.1. Introduction**

This is an optional section for any supplementary material that documents important components of the thesis/dissertation/exegesis research process. Appendices should be formatted according to APA style or other approved reference style. The content of the appendices may vary depending on the methodology used however, the following is a guide on what should be included in the appendix:

**Appendix A:** Ethics Approval (may be more than one letter) **Appendix B:** Tools

- a) Interviews, focus group, observation guide
- b) Participant Information Sheet
- c) Consent form
- d) Letters of support (if applicable) or support services
- e) Letter requesting access

**Appendix C:** Sample of coding or sample of thematic analysis (if applicable) **Appendix D:**  
Research outputs from thesis or publication from thesis (if applicable)

**Other appendices** may include (if applicable):

- Glossary
- Transcriber confidentiality agreement
- Profiles

## **Appendix B**

# **MORE ADDITIONAL INFORMATION HERE**

### **B.1. Introduction**

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## **B.2. Conclusion**

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