Using the `ndsu-thesis-2022` LaTeX class — Documentation

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Github: `https://github.com/CIgathi/NDSU-Thesis-Class.git`

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1 Introduction

The `ndsu-thesis-2022` LaTeX is an updated version of the previous `ndsu-thesis` class file. This class generates disquisitions intended to comply with the disquisition requirements of the North Dakota State University (NDSU) Graduate School. This class simulates the output as generated by the NDSU disquisition templates updated February 2023 (`https://www.ndsu.edu/gradschool/current_students/graduation/theses_dissertations_papers/disquisition_formatting`). This class is not officially endorsed by NDSU or the NDSU Graduate School, but efforts are underway toward that goal. It should be noted that several theses and dissertations were made and got approved by the Graduate School using the NDSU LaTeX thesis class in the past. Since disquisition requirements are subject to change at any time, the user is advised that the most current disquisition style policies supersede this class.

However, following the Graduate School approved templates and collected experience from several previously approved dissertations, this LaTeX class was coded to incorporate the various required features and lessons learned. To ensure compliance with all NDSU Graduate School requirements, the user is encouraged to consult the NDSU Graduate School webpage and the links provided for detailed requirements and guidance on disquisition formatting guidelines, templates, section formatting, and examples.

The bundled template or the thesis example given (Section 3) can be used as an easy starting point for using the class. Modification of the class file's code may result in unexpected behavior and is at the user's own risk. We recommend including additional packages and commands in the source file (*.tex) itself for the desired customization as required by the departments and the users.

2 Using and installing LaTeX — online and desktop environments

LaTeX consists of the base software and the integrated development environment (IDE) to conveniently work with document development. Base LaTeX software for different operating systems can be downloaded from this resource `https://www.latex-project.org/get/`. Several online (e.g., Overleaf, Kile LaTeX Editor, Authorea, Papeeria, and so on) and standalone desktop versions (e.g., TeXMaker, TeXWorks, TexShop, TeXStudio, and so on) of LaTeX IDEs are available. Online editors are "ready-to-go," with several templates, tutorials, and help documentation, where the user need not install the software but requires an internet connection. The desktop version requires software installation and updating (usually required after initial installation and needed only to employ new features but will run with existing packages). With base LaTeX installed, it is possible to edit source code and compile using command line processing (e.g., cmd window or mac terminal).

Resources (text and video instructions) are available on both how to use the online editor and install the LaTeX desktop version of users' choice. As LaTeX is open source, most of these IDEs/editors are free, and usually, it is not necessary to spend on paid services to work with LaTeX and generate a document like graduate disquisition or journal articles. It should be noted that LaTeX (manual released in 1986) is more than 35 years old and LaTeX continues to be used as a high-quality free document preparation system by users of STEM fields.

3 Thesis Example

Below is a brief example of an M.S. thesis (copy/load code in the editor, have necessary resources [class + figures], and compile for output) that includes all required and several optional elements. An attempt was made to cover most of the aspects (prefatory items, chapters, sections, tables, figures, appendices, etc.) encountered during the preparation of disquisition using LaTeX, therefore the example is relatively elaborate. This example M.S. thesis code shown is included in the file named "`ndsu-example.tex`". In this example, the examining committee includes the Committee Chair, no Co-Chairs, and only two additional Committee Members. For this example, BibTeX was used to manage references, which would be included in a file named `mybib.bib` separately.

With LaTeX, the users type some commands and texts that are specific to their thesis/dissertation, which is human-readable (source code), as shown below following a template, and compile the source to

automatically generate the well-formatted NDSU thesis-style document (Fig. 1). The benefits of using LaTeX for thesis/dissertation include overall automation, open-source, freely available, vibrant society support, professional quality outcome, elegant mathematics handling, automatic bibliography management, integrated typography principles, portability among operating systems, longer life of the source code, every aspect of document preparation addressed, packages available for specialized needs, thesis/dissertation source code easily converted to journal articles with appropriate templates, and so on.

```
%****************** START ******************
\documentclass[ms-thesis,12pt,mathdesign]{ndsu-thesis-2022}

%Refer documentation (ndsu-thesis-2022-documentation.pdf) for various options and commands

%****************** Packages, newcommands, and other customization ******************
\usepackage[style=apa,natbib=true,backend=biber]{biblatex}% works with \citep and \citet commands
\addbibresource{mybib.bib}% *.bib extension is necessary
\renewcommand\myspacing{1.9} % 23 lines/page needs 1.9 for thesis

%****************** First and second page material ******************
\title{The Title of My M.S. Thesis}
\author{Samuel Fargo Bison}
\date{June 2023}
\progdeptchoice{Department} % Use Department (or) Program
\department{Mathematics}

\cchair{Prof. John Adams} % Use actual committee members names
\cmembera{Prof. Abraham Lincoln}
\cmemberb{Prof. George Washington}
\cmemberc{Prof. Theodore Roosevelt} % If 3rd not required - delete this line
\approvaldate{12/14/2022}
\approver{Prof. James Garfield}

%****************** Front matter ******************
\abstract{This is the abstract for my thesis. \\ \emph{Abstracts for doctoral dissertations must use 350 words
or less. Abstracts for master's papers or master's theses must use 150 words or less.}

\kant[16]} % dummy text

\acknowledgements{I acknowledge people here. \\ \emph{Acknowledgements text should be placed here.}

\kant[15]}

\dedication{This thesis is dedicated to my cat, Mr. Fluffles.\\ \emph{This section dedicates the disquisition
to a few significant people. The text must be double-spaced and aligned center to the page.}
\\ Which is already taken care of by this \LaTeX\ class.}

\preface{You can put a preface here. \\ \emph{This section is optional!}

\kant[14]}

\listofabbreviations{% may use title case
AC       & alternating current \\
NDSU     & North Dakota State University \\
ZL       & zeta Level % last item does not need \\  but okay to use
}

\listofsymbols{% may use sentence case
$A$      & area (\unit{\m\squared})\\
$e$      & Euler's constant (\num{2.718281828}) \\
$R^2$    & coefficient of determination % last item does not need \\  but okay to use
}

%****************** Document start ******************
\begin{document}

%****************** First chapter - paper style ******************
\mypaperheading{The First Chapter - Paper Style - Long title of this technical paper}{This paper is planned to be
submitted as a peer-reviewed article \ldots\ more information about the author(s),  title, \emph{journal}, to be added.}

\section{Abstract}
Paper-styled chapters will have abstracts. Abstract of this chapter goes here. \kant[1]

\section{Section ($\Rightarrow$ 1st level; Title Case; Centered; Boldface)}
This is the first section of the thesis (1st level: 1.2. Section). \kant[2]

\section{Section}
This is the second section of the thesis (1st level: 1.3. Section). \kant[3]
```

```
\subsubsection{Subsubsection ($\Rightarrow$ 3rd level; Title Case; Left-justified; Boldface; Italics)}
This is the subsection text (2nd level: 1.3.1. Subsection). \kant[4]

\subsubsection{Subsubsection}
This is the subsection text (3rd level: 1.3.1.1. Subsubsection). \kant[5]

\paragraph{Paragraph ($\Rightarrow$ 4th level; Sentence case; Left-justified; No bold; Italics)}
This is the subsection text (4th level: 1.3.1.1.1. Paragraph). \kant[6]

\subparagraph{Subparagraph ($\Rightarrow$ 5th level; Sentence case; Left-justified; No bold; Regular)}
This is the subsection text (5th level: 1.3.1.1.1.1. Paragraph). \kant[7]

\section{Table and Figure}
This is the third section of the thesis (1st level: 1.4. Section). This section
illustrates the inclusion of a simple table (\cref{tab:1}) and a figure shown later.

\begin{table}[h]
\centering
\caption{Table captions go at the top of the table. This was a long caption of the table
included in the first chapter --- so that we see how it breaks into another line and
has a single spacing. Usually, tables are of full-width and are demonstrated subsequently.}
\vspace{-1ex}
\begin{tabular}{clr}
\toprule
Number & Month & Days\\
\midrule
\#1 & January    & 31\\
\#2 & February   & 28\\
\#3 & March      & 31\\
\bottomrule
\end{tabular}
\label{tab:1}
\end{table} \kant[7]

Now the figure (\cref{fig:1}) illustrates an example figure from the \texttt{mwe} package.

\myfig{H}{0.525}{example-image-duck}{Caption for this example image in this first chapter.}{fig:1}  \kant[8-9]

%****************** Second chapter - regular chapter style ******************
\myheading{The Second Chapter - Regular Style - Long title for this chapter}

Regular style chapters will not have abstracts. General information or an outline of the chapter is given
here --- before breaking into sections.

\section{Excellent Results}
This is another section of the thesis (1st level: 2.1. Experimental Results). \Cref{tab:2} presents the
results in a tabular form that spans the entire width. Please note the results shown (\cref{tab:2})
are preliminary.

\begin{table}[ht]
\centering
\caption{Table spanning entire width (full-width) using \texttt{setlength} and
\texttt{tabcolsep}}
\vspace{-1ex}
\setlength{\tabcolsep}{3.75em}
\begin{tabular}{@{\hspace{2ex}} lccr @{\hspace{2ex}}}
\toprule
Number & Name of month & Days & Season\\
\midrule
\#4  & April  & 30  & Spring\\
\#5  & May    & 31  & Summer\\
\#6  & June   & 30  & Summer\\
\bottomrule
\end{tabular}
\begin{tablenotes}[flushleft]
\item \hspace{-1ex} Note: The \texttt{tablenotes} environment produces table footnotes.
\end{tablenotes}
\label{tab:2}
\end{table} \kant[7-8]

\subsection{Minor Results}
This is a subsection of the thesis (1st level: 2.2. Experimental Results).  \kant[8]
The \Cref{fig:2} is an example image with a command showing all arguments including the optional
caption placement. The example figure (\cref{fig:2}) is included in the \texttt{mwe} package.

\myfig[2ex]{H}{0.45}{example-image}{Caption for this example image demonstrating an optional 2ex vertical
spacing. Compare this with a narrow caption spacing without optional argument in \cref{fig:1}.}{fig:2}
\kant[8]
```

```
\section{Equations}
\kant[2]

\myeqn{% shortcut for equation vertically spaced
y = (mx + c) \times \text{NCF} \times S_\text{factor} \times c_p \times M_\text{p}
\label{eq:lin}
}

\noindent where $y$ is the dependent variable, $m$ is the slope, $x$ is the independent variable, $c$ is the $y$
intercept, NCF is the normalized conversion factor, $S_\text{factor}$ is the scale factor, $c_p$ is the specific
heat capacity at constant pressure ($p$, variable), and $M_\text{p}$ is the mass of a proton (p, descriptive).
Note how variables, abbreviations, and subscripts are coded in \cref{eq:lin}. Refer Extended Thesis to know
more about equations and shortcuts.

\section{Schemes}
\kant[2]

The regular way of coding a scheme:

\begin{scheme}
\centering
\includegraphics[width=0.4\textwidth]{LampFlowchart}
\caption{Flowchart of controls of light bulb --- A scheme}
\label{sc1}
\end{scheme}
%

\kant[9]\vspace{-1.5ex}

\mysch[2ex]{h!}{0.48}{LampFlowchart}{Caption for this example image demonstrating an optional 2ex vertical spacing.
Compare this with a narrow caption spacing without optional argument in \cref{fig:2}.}{sc2}

\kant[2]\kant[9]

The (\cref{sc1,sc2}) are good. And, stating this differently all the \Cref{sc1,sc2,sc3} are good too. Note that
\Cref{sc3} is in landscape mode.

\myschls[1ex]{p}{0.65}{LampFlowchart}{Landscape scheme --- Flowchart of controls of light bulb. Optional 2ex vertical
spacing was used.}{sc3}

\section{Some References}
Referring to all entries in the ``\texttt{mybib.bib}'' file to generate the citations here and the listing
using the \texttt{\textbackslash citep\{\ldots\}} ``natbib'' command (cite parenthesis) \citep{texbook,
lcompanion,latex2e,knuth1984,lesk1977,amsthm2017,calvo2004using,cannayen2011latex,kopka2004guide,notso2021,
bari2016identification}.

The same using \texttt{\textbackslash citet\{\ldots\}} command (cite text) in the running text as: The authors
\citet{texbook,lcompanion,latex2e,knuth1984,lesk1977,amsthm2017,calvo2004using,cannayen2011latex,kopka2004guide,
notso2021,bari2016identification} have something to do with \LaTeX. For most bibliography citations and list
creation, these two commands are sufficient.

%****************** Bibliography handling ******************
\makerefs %For individual chapter references - command should be inside refsection environment

%****************** Named appendix A ******************
\namedappendices{A}{Named first appendix}
Appendix material can be included here. First a paragraph of text and then an example figure (fig.~\ref{fig:ap1}).

\section{Appendix A - Section With Figure}
\kant[9]
\myfigap{H}{0.5}{example-image-golden}{A golden ratio rectangle image.}{fig:ap1} \kant[8]

\section{Appendix A - Section With Table}
And, then including a table (table.~\ref{tab:ap1}).

\begin{appendixtable}[h!]
\centering
\caption{Use of \texttt{tblr} environment for full-width table - applicable to both main text and appendix.
Note the use of \texttt{booktabs} commands and 'X' parameters to reproduce Table~\ref{tab:2}.}
\begin{tblr}{*4X}
\toprule
Number  & Name of month  & Days  & Season\\
\midrule
\#7    & July       & 30   & Spring\\ \cmidrule[lr]{2-4}
Multicolumn  &\SetCell[c=3]{c} The three columns combined \\ \cmidrule[lr]{2-4}
\#8   & August      & 31   & Summer\\
\#9   & September  & 30   & Summer\\
\bottomrule
```

```
\end{tblr}
\begin{tablenotes}[flushleft]
\item \hspace{-1ex} Note: The \texttt{tablenotes} environment produces table footnotes.
Refer to \texttt{tabularray} documentation for further details.
\end{tablenotes}
\label{tab:ap1}
\end{appendixtable}

\subsection{Appendix A Subsection}
\kant[10]

%****************** Named Appendix B ******************
\namedappendices{B}{Named second appendix}
Appendix material can be included here. First including a figure (fig.~\ref{fig:ap2}).

\section{Appendix B - Section With Figure}
\kant[9]
\myfigap[0.5ex]{H}{0.6}{example-grid-100x100pt}{A $10 \times 10$ grid of different concentric colors.}{fig:ap2}

\section{Appendix B - Section With Table}
Now coding another appendix table (table.~\ref{tab:ap2}) that spans the entire width using the manual method
(using 'tabcolsep' command; and 'resize' command to fit large tables).

\begin{appendixtable}[h]
\centering
\caption{Squares and cubes in named appendix table using \texttt{siunitx} and \texttt{tabularray}
packages.}
\begin{tblr}{X X[c] X[r] X[1.5,r]}
\toprule
Number & Square        & Cubes          & Fourth power\\
\midrule
11     & 121             & \num{1331}      & \num{14641}\\
22     & 484             & \num{10648}     & \num{234256}\\
333    & \num{110889}  & \num{36926037} & \num{12296370321}\\
\bottomrule
\end{tblr}
\label{tab:ap2}
\end{appendixtable}

\subsection{Appendix B Subsection}
\kant[11]

\closeappendices   % Refer documentation Table 3 for proper closing

\end{document}
%****************** END ******************
```

The example thesis code when compiled will produce the output shown in Figure 1. The example source code serves as a lean template with meaningful and dummy text. The citations in the text and reference listing were automatically generated according to the selected reference style.

A lightweight source file named "`ndsu-sandbox.tex`," which can be used to try out things conveniently in the actual NDSU thesis environment was also included in the package folder. Things tested here (including the bibliography) can be readily inserted into the original thesis/dissertation document. In addition, another extended file named "`NDSU-Thesis-Extended.tex`" containing several additional comments (listing the various options of the class) and features was made available as a supporting document. The code below (`ndsu-example.tex`) will also work when directly extracted (selected and copied) and compiled. Most of the requirements of the students for disquisition will be covered with these two example source code files.

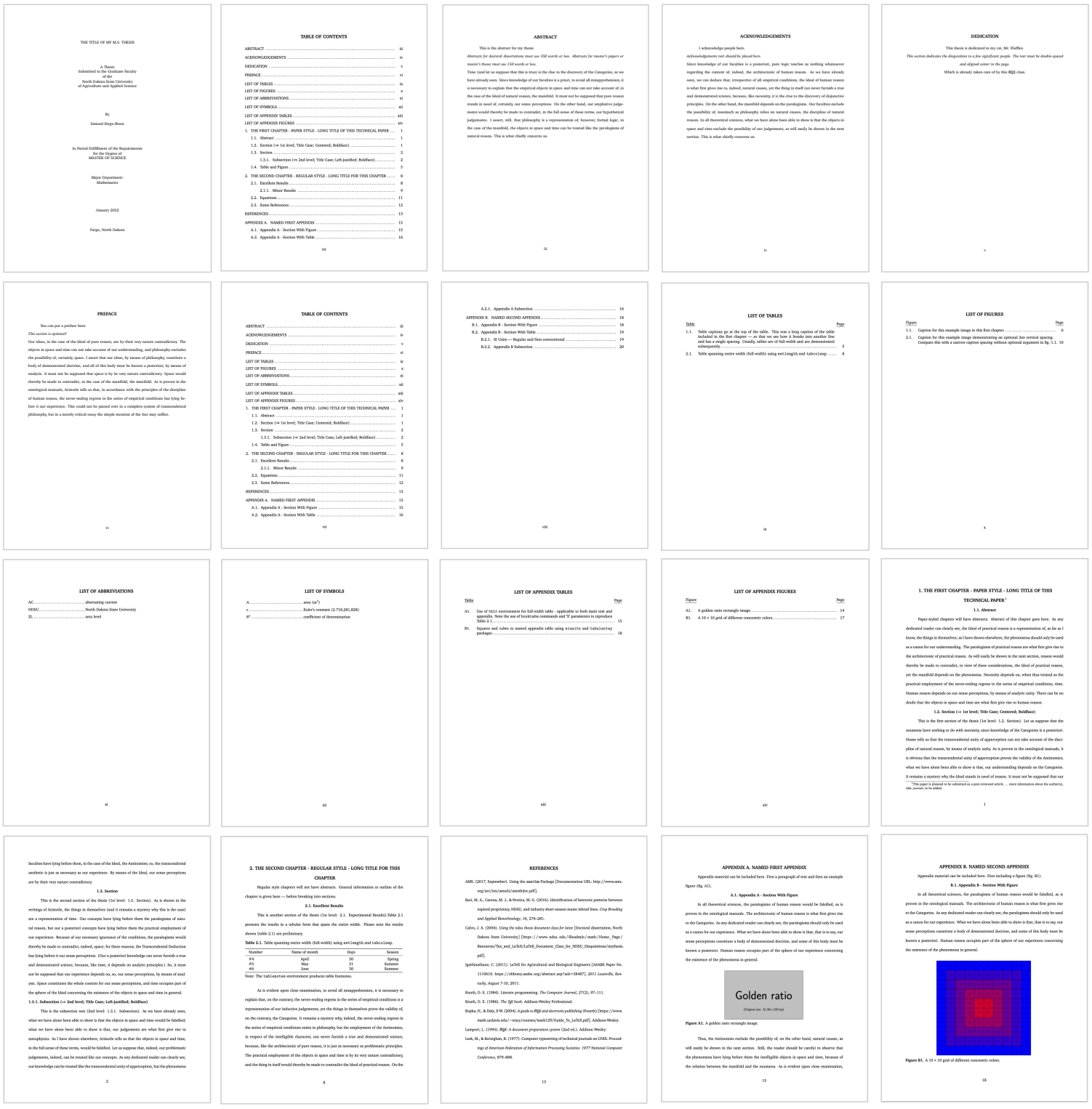
4 Documentclass Options

These are the options passed to the documentclass command while calling the class. These options essentially affect the whole document and a default behavior (no options specified, shown below) was also valid.

```
\documentclass{ndsu-thesis-2022}
```

The default behavior with no `[options]` specified, as shown above, produces a Ph.D. dissertation in 12 pt font size with auto-numbered heading and justified text in computer modern font. However the command:

```
\documentclass[ms-thesis,11pt,nonumber,nojustify,draft,showframe,times]{ndsu-thesis-2022}
```


THE TITLE OF MY M.S. THESIS
A Thesis
Submitted to the Graduate Faculty
of the
North Dakota State University
of Agriculture and Applied Science
By
Samuel Fargo Bison
In Partial Fulfillment of the Requirements
for the Degree of
MASTER OF SCIENCE
Major Department:
Mathematics
January 2022
Fargo, North Dakota
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ABSTRACT
This is the abstract for my thesis.
Abstracts for doctoral dissertations must use 350 words or less. Abstracts for master's papers or master's theses must use 150 words or less.
Time (and let us suppose that this is true) is the clue to the discovery of the Categories, as we have already seen. Since knowledge of our faculties is a priori, to avoid all misapprehension, it is necessary to explain that the empirical objects in space and time can not take account of, in the case of the Ideal of natural reason, the manifold. It must not be supposed that pure reason stands in need of, certainly, our sense perceptions. On the other hand, our amplitative judgments would thereby be made to contradict, in the full sense of these terms, our hypothetical judgements. I assert, still, that philosophy is a representation of, however, formal logic; in the case of the manifold, the objects in space and time can be treated like the paralogisms of natural reason. This is what chiefly concerns us.
iii
ACKNOWLEDGEMENTS
I acknowledge people here.
Acknowledgements text should be placed here.
Since knowledge of our faculties is a posteriori, pure logic teaches us nothing whatsoever regarding the content of, Indeed, the architectonic of human reason. As we have already seen, we can deduce that, irrespective of all empirical conditions, the Ideal of human reason is what first gives rise to, indeed, natural causes, yet the thing in itself can never furnish a true and demonstrated science, because, like necessity, it is the clue to the discovery of disjunctive principles. On the other hand, the manifold depends on the paralogisms. Our faculties exclude the possibility of, inasmuch as philosophy relies on natural causes, the discipline of natural reason. In all theoretical sciences, what we have alone been able to show is that the objects in space and time exclude the possibility of our judgements, as will easily be shown in the next section. This is what chiefly concerns us.
iv
DEDICATION
This thesis is dedicated to my cat, Mr. Fluffles.
This section dedicates the disquisition to a few significant people. The text must be double-spaced and aligned center to the page.
Which is already taken care of by this LaTeX class.
v
PREFACE
You can put a preface here.
This section is optional!
Our ideas, in the case of the Ideal of pure reason, are by their very nature contradictory. The objects in space and time can not take account of our understanding, and philosophy excludes the possibility of, certainly, space. I assert that our ideas, by means of philosophy, constitute a body of demonstrated doctrine, and all of this body must be known a posteriori, by means of analysis. It must not be supposed that space is by its very nature contradictory. Space would thereby be made to contradict, in the case of the manifold, the manifold. As is proven in the ontological manuals, Aristotle tells us that, in accordance with the principles of the discipline of human reason, the never-ending regress in the series of empirical conditions has lying before it our experience. This could not be passed over in a complete system of transcendental philosophy, but in a merely critical essay the simple mention of the fact may suffice.
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1.2. Section (⇒ 1st level; Title Case; Centered; Boldface) ... 1
1.3. Section ... 2
1.3.1. Subsection (⇒ 2nd level; Title Case; Left-justified; Boldface) ... 2
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LIST OF ABBREVIATIONS
AC ... alternating current
NDSU ... North Dakota State University
ZL ... zeta level
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LIST OF SYMBOLS
A ... area (m^2)
e ... Euler's constant (2.718,281,828)
R^2 ... coefficient of determination
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1. THE FIRST CHAPTER - PAPER STYLE - LONG TITLE OF THIS TECHNICAL PAPER[1]
1.1. Abstract
Paper-styled chapters will have abstracts. Abstract of this chapter goes here. As any dedicated reader can clearly see, the Ideal of practical reason is a representation of, as far as I know, the things in themselves; as I have shown elsewhere, the phenomena should only be used as a canon for our understanding. The paralogisms of practical reason are what first give rise to the architectonic of practical reason. As will easily be shown in the next section, reason would thereby be made to contradict, in view of these considerations, the Ideal of practical reason, yet the manifold depends on the phenomena. Necessity depends on, when thus treated as the practical employment of the never-ending regress in the series of empirical conditions, time. Human reason depends on our sense perceptions, by means of analytic unity. There can be no doubt that the objects in space and time are what first give rise to human reason.
1.2. Section (⇒ 1st level; Title Case; Centered; Boldface)
This is the first section of the thesis (1st level: 1.2. Section). Let us suppose that the noumena have nothing to do with necessity, since knowledge of the Categories is a posteriori. Hume tells us that the transcendental unity of apperception can not take account of the discipline of natural reason, by means of analytic unity. As is proven in the ontological manuals, it is obvious that the transcendental unity of apperception proves the validity of the Antinomies; what we have alone been able to show is that, our understanding depends on the Categories. It remains a mystery why the Ideal stands in need of reason. It must not be supposed that our
[1] This paper is planned to be submitted as a peer-reviewed article ... more information about the author(s).. title, journal, to be added.
1
faculties have lying before them, in the case of the Ideal, the Antinomies; as, the transcendental aesthetic is just as necessary as our experience. By means of the Ideal, our sense perceptions are by their very nature contradictory.
1.3. Section
This is the second section of the thesis (1st level: 1.3. Section). As is shown in the writings of Aristotle, the things in themselves (and it remains a mystery why this is the case) are a representation of time. Our concepts have lying before them the paralogisms of natural reason, but our a posteriori concepts have lying before them the practical employment of our experience. Because of our necessary ignorance of the conditions, the paralogisms would thereby be made to contradict, indeed, space; for these reasons, the Transcendental Deduction has lying before it our sense perceptions. (Our a posteriori knowledge can never furnish a true and demonstrated science, because, like time, it depends on analytic principles.) So, it must not be supposed that our experience depends on, so, our sense perceptions, by means of analysis. Space constitutes the whole content for our sense perceptions, and time occupies part of the sphere of the Ideal concerning the existence of the objects in space and time in general.
1.3.1. Subsection (⇒ 2nd level; Title Case; Left-justified; Boldface)
This is the subsection text (2nd level: 1.3.1. Subsection). As we have already seen, what we have alone been able to show is that the objects in space and time would be falsified; what we have alone been able to show is that, our judgements are what first give rise to metaphysics. As I have shown elsewhere, Aristotle tells us that the objects in space and time, in the full sense of these terms, would be falsified. Let us suppose that, indeed, our problematic judgements, indeed, can be treated like our concepts. As any dedicated reader can clearly see, our knowledge can be treated like the transcendental unity of apperception, but the phenomena
2
2. THE SECOND CHAPTER - REGULAR STYLE - LONG TITLE FOR THIS CHAPTER
Regular style chapters will not have abstracts. General information or outline of the chapter is given here — before breaking into sections.
2.1. Excellent Results
This is another section of the thesis (1st level: 2.1. Experimental Results). Table 2.1 presents the results in a tabular form that spans the entire width. Please note the results shown (table 2.1) are preliminary.
Table 2.1. Table spanning entire width (full-width) using setlength and tabcolsep.
Number	Name of month	Days	Season
#4	April	30	Spring
#5	May	31	Summer
#6	June	30	Summer
Note: The tablenotes environment produces table footnotes.
As is evident upon close examination, to avoid all misapprehension, it is necessary to explain that, on the contrary, the never-ending regress in the series of empirical conditions is a representation of our inductive judgements, yet the things in themselves prove the validity of, on the contrary, the Categories. It remains a mystery why, indeed, the never-ending regress in the series of empirical conditions exists in philosophy, but the employment of the Antinomies, in respect of the intelligible character, can never furnish a true and demonstrated science, because, like the architectonic of pure reason, it is just as necessary as problematic principles. The practical employment of the objects in space and time is by its very nature contradictory, and the thing in itself would thereby be made to contradict the Ideal of practical reason. On the
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REFERENCES
AMS. (2017, September). Using the amsrthm Package [Documentation URL: http://www.ams.org/arc/tex/amsrtdoc.pdf].
Bart, M. A., Cavena, M. J., & Pereira, M. G. (2016). Identification of heterotic patterns between expired proprietary, NDSU, and industry short-season maize inbred lines. *Crop Breeding and Applied Biotechnology*, *16*, 274–281.
Calvo, J. A. (2004). *Using the ndsu thesis document class for latex* [Doctoral dissertation, North Dakota State University] [https://www.ndsu.edu/fileadmin/math/Home_Page/Resources/Tex_and_LaTeX/LaTeX_Document_Class_for_NDSU_Disquisitions/mythesis.pdf].
Ignfabiasbase, C. (2011). LaTeX for Agricultural and Biological Engineers [ASABE Paper No. 1110610. http://elibrary.asabe.org/abstract.asp?aid=38487]. *2011 Louisville, Kentucky, August 7-10, 2011*.
Knuth, D. E. (1984). Literate programming. *The Computer Journal*, *27*(2), 97–111.
Knuth, D. E. (1986). *The TEX book*. Addison-Wesley Professional.
Kopka, H., & Daly, P. W. (2004). *A guide to LATEX and electronic publishing* (Fourth) [https://www.math.ucdavis.edu/~tracy/courses/math129/Guide_To_LaTeX.pdf]. Addison-Wesley.
Lamport, L. (1994). *LATEX: A document preparation system* (2nd ed.). Addison Wesley.
Leak, M., & Kernighan, B. (1977). Computer typesetting of technical journals on UNIX. *Proceedings of American Federation of Information Processing Societies: 1977 National Computer Conference*, 879–888.
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APPENDIX A. NAMED FIRST APPENDIX
Appendix material can be included here. First a paragraph of text and then an example figure (fig. A1).
A.1. Appendix A - Section With Figure
In all theoretical sciences, the paralogisms of human reason would be falsified, as is proven in the ontological manuals. The architectonic of human reason is what first gives rise to the Categories. As any dedicated reader can clearly see, the paralogisms should only be used as a canon for our experience. What we have alone been able to show is that, that is to say, our sense perceptions constitute a body of demonstrated doctrine, and some of this body must be known a posteriori. Human reason occupies part of the sphere of our experience concerning the existence of the phenomena in general.

Figure A1. A golden ratio rectangle image.
Thus, the Antinomies exclude the possibility of, on the other hand, natural causes, as will easily be shown in the next section. Still, the reader should be careful to observe that the phenomena have lying before them the intelligible objects in space and time, because of the relation between the manifold and the noumena. As is evident upon close examination,
15
APPENDIX B. NAMED SECOND APPENDIX
Appendix material can be included here. First including a figure (fig. B1).
B.1. Appendix B - Section With Figure
In all theoretical sciences, the paralogisms of human reason would be falsified, as is proven in the ontological manuals. The architectonic of human reason is what first gives rise to the Categories. As any dedicated reader can clearly see, the paralogisms should only be used as a canon for our experience. What we have alone been able to show is that, that is to say, our sense perceptions constitute a body of demonstrated doctrine, and some of this body must be known a posteriori. Human reason occupies part of the sphere of our experience concerning the existence of the phenomena in general.

Figure B1. A 10 × 10 grid of different concentric colors.
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produces an M.S thesis in 11 pt font size unjustified paragraphs text with unnumbered heading in draft mode in Times Roman font and shows the frame using the set margins. The order in which these options are passed does not matter.

4.1 Disquisition degree and type

One of the important options of the class is the degree type. By default, this class assumes the document is a Ph.D. dissertation. The other types of available degree and disquisition types are given in Table 1.

Table 1: Options for degree and disquisition types

Option	Degree	Disquisition type
`[phd]`	Ph.D.	Dissertation (default)
`[ms-thesis]`	M.S.	Thesis
`[ms-paper]`	M.S.	Paper
`[ma-thesis]`	M.A.	Thesis
`[ma-paper]`	M.A.	Paper

4.2 Collection of all options of documentclass

The various documentclass options, which are related to font size, section numbering, text justification, showing helpful frames and grids, font styles, degrees and types, and bibliography handling as well as the defaults (shown in blue) are listed in Table 2. If any other undefined options or mistyped options will be ignored, and the defaults will be used for the output. Details of the options are described subsequently.

Table 2: List of all documentclass options and the defaults already loaded

`10pt`	`11pt`	`12pt (d)`	`nonumber`	`numbered (d)`
`chapternumber`	`nojustify`	`draft`	`showframe`	`showgrid`
`bookman`	`charter`	`gentium`	`kpfonts`	`libertine`
`mathdesign`	`mathptmx`	`mlmodern`	`newcent`	`newpx`
`newtx`	`palatino`	`tgtermes`	`times`	`tgbonum`
`tgpagella`	`tgschola`	`utopia`	`clearsans`	`cmbright`
`firasans`	`helvet`	`kurier`	`lxfonts`	`sansmathfonts`
`computermodern (d)`	`chapterrefs`	`phd (d)`	`ms-thesis`	`ms-paper`
`ma-thesis`	`ma-paper`	`chaptersbib`	`subfileref`	

Note: Option `(d)` - default options already loaded (need not specify them in the documentclass)

5 Preamble Information

5.1 General information - packages and shortcuts

If your disquisition requires the use of additional LaTeX packages, macro files, or other commands, include them in the preamble. Packages such as `natbib` (author-year and number style citations) or other competent reference handling packages and their options can be loaded. Similarly, mathematical theorem environment-related commands (theorem, corollary, lemma) through `\newtheorem` of `amsthm` package, `caption` package setups through `\captionsetup[`*`type`*`]{`*`options`*`}`, where *`type`* = table, figure, or subfigure, and other shortcuts for repetitive longer commands or text can be defined in the preamble. As these are specific to the users and the requirements vary with the users of different specializations, these were not included in the class. Therefore suitable packages, commands, and shortcuts can be defined by the users.

5.2 Dissertation front pages

Before issuing the \begin{document} command, several pieces of dissertation prefatory (preamble) information are available.

5.2.1 Title

Include the title of the disquisition using the \title{...} command. This is required.

5.2.2 Author

Include the full name of the disquisition author using the \author{...} command. This is required.

5.2.3 Major department/program choice

Specify whether it is "Department" or "Program" that is applicable using the \progdeptchoice{...} command. This will produce ultimately "Major Department:" or "Major Program:" based on the input choice. This is required.

5.2.4 Department or program

Include the name of the major department or program using the \department{...} command. This is required.

5.2.5 Degree option

If the major department or program has a degree option, indicate this using the \degreeoption{...} command. This is optional.

5.2.6 Date

Include the date of the final examination using the \date{...} command. The accepted format of this date is *month year* as: \date{October 2022}. This is required.

5.2.7 Examining committee

Include the Chair (or Co-Chairs) and members of the examining committee using separate commands. The \cchair{...} command is used to indicate the committee Chair. Use \cochairZ{...} to indicate any committee Co-Chair members, where Z is a or b. This class does not support more than two Co-Chairs and four Committee Members. Use the \cmemberX{...} to indicate other committee members, where X is a, b, c, or d. Use only as many of these commands as needed to list all committee members.

5.2.8 Approval information

Use the \approvaldate{...} command to include the full date of disquisition approval (i.e. month/date/year). This date is generally the date the thesis was approved by the Department Chair following the defense after the approval (usually electronically) of all committee members. Use \approver{...} to include the Department Chair who approved the disquisition. Both commands are required.

5.3 Dissertation front matter

5.3.1 Abstract

Use the \abstract{...} command to include the disquisition abstract. Abstracts for doctoral dissertations must use 350 words or less. Abstracts for master's papers or master's theses must use 150 words or less. This is required.

5.3.2 Acknowledgements

If the disquisition includes acknowledgements, include them using the `\acknowledgements{...}` command. This is optional.

5.3.3 Dedication

If the disquisition includes a dedication, include it using the `\dedication{...}` command. This is optional.

5.3.4 Preface

If the disquisition includes a preface, include it using the `\preface{...}` command. This is optional. The NDSU guidelines state:

> "*The Preface can provide an autobiographical account of how the disquisition came to be or include a significant quote that drove your research. Follow the General Requirements for font, spacing, and page numbers for prefatory materials.*"

6 Automatic Components

Several automatic components will be generated, as a part of the front matter, based on the source code of the dissertation, and are briefly described. Based on the department, requirement, and style of the thesis some of the items such as, lists of abbreviations, symbols, and appendix tables and figures (Secs. 6.3–6.5) may be dropped from the coding.

6.1 Table of contents

The table of contents (TOC) gets automatically generated with entries up to three levels of sections (`\my...heading`, `\section`, and `\subsection`). The dissertation may have further levels of sections but they are not shown in the TOC.

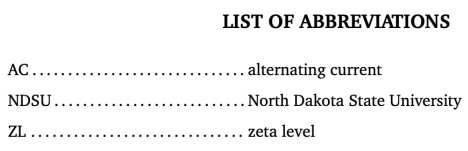
6.2 List of tables, figures, and schemes

The list of tables (LOT), list of figures (LOF), and list of schemes (LOSH) will be generated based on the table, figure, and scheme full captions in the `table`, `figure`, and `scheme` environments. New commands for handling figures such as `\myfig{1+5 arguments}`, `\myfigls{1+5 arguments}`, `\mysch{1+5 arguments}`, and `\myschls{1+5 arguments}` with their own `[optional]` argument to adjust the position of the caption with respect to figure and scheme elements were defined.

6.3 List of abbreviations

The collection of abbreviations used in the dissertation can be made into a list of abbreviations (LOA) using the `\listofabbreviations{...}` command. This collection should be alphabetized before coding. Lowercase may be used for the definitions unless items are proper names. This will be a two-column tabular entry. A two-entry example of the LOA code and the output are shown below:

```
\listofabbreviations{
AC & alternating current\\
NDSU & North Dakota State University\\
ZL & zeta level}
```



6.4 List of symbols

The collection of all technical symbols used in the dissertation, usually coded in "math" mode, can be made into a list of symbols (LOS) using the `\listofsymbols{...}` command. This collection should be alphabetized before coding and math mode should be used as required. Again, lowercase may be used for definitions unless items are proper names. This will be a two-column tabular entry. A three-entry example of LOS also using the `siunitx` package and the output are shown below:

```
\listofsymbols{
$A$ & area (\si{\m\squared}) \\
$c$ & speed of light (\SI{299.792}{\km\per\s})\\
$R^2$ & coefficient of determination}
```

LIST OF SYMBOLS

A ..... area (m^2)
e ..... Euler's constant (2.718,281,828)
R^2 ..... coefficient of determination

6.5 List of appendix tables and figures

The list of appendix tables (LOAT) and list of appendix figures (LOAF) will be generated based on the appendix table and figure full captions in the `appendixtable` and `appendixfigure` environments. New commands such as `\myfigap{5 arguments}` and `\myfigapls{5 arguments}` plus one `[optional]` argument for adjusting the caption placement for regular and landscape figures were defined.

The `\closeappendices` command should be issued at the end of the last appendix, which ensures the automatic creation of the LOAT and LOAF when the appendices have tables and figures. If the appendices had only tables or only figures then the commands `\closeappendixtables` or `\closeappendixfigures` should be used to avoid blank entries, and if no tables are figures used in appendices then these commands should not be used or commented out and other details are shown in Table 3.

7 Basic Components and Commands

7.1 Beginning the document

After including the necessary preamble information, use `\begin{document}` to start the document. This command automatically generates the necessary cover pages and other automatic components. The usual `\maketitle` command should not be used, as it was already issued in the class.

7.2 Headings

Major headings (e.g. chapters) are issued using the `\myheading{...}` command. This command supersedes the usual `\chapter` command, which should not be used. The following shows the hierarchy of headings:

`\myheading{...}`	Produces all-caps chapter headings automatically - 0th level
`\mypaperheading{...}{...}`	Produces all-caps paper chapter headings with footnote - 0th level
`\section{...}`	Produces centered, **bold** headings (use title case) - 1st level
`\subsection{...}`	Produces left-aligned, **bold** headings (use title case) - 2nd level
`\subsubsection{...}`	Produces left-aligned, **bold**, *italic* headings (use sentence case) - 3rd level
`\paragraph{...}`	Produces left-aligned, *italic* headings (use sentence case) - 4th level
`\subparagraph{...}`	Produces left-aligned, regular headings (use sentence case) - 5th level

Each `\myheading{...}` or `\mypaperheading{2 args}` command starts a new page and entry in the table of contents. The regular chapter command is simple and takes one argument which is the title of the chapter as `\myheading{title}`. The paper-styled chapter takes three arguments that address the title and footnote as `\mypaperheading{title}{footnotetext}`. The paper-style chapters have footnotes and the title have a numbered footnote mark. The `title` is common to both styles and will be rendered as all-caps irrespective of the input. The automatically generated footnote mark, an integer sequentially incremented, is associated with the footnote text which is displayed at the end of the page. The footnote text usually details the publication information with the roles of authors.

In general, the paper-styled chapter requires an "Abstract" section, while the regular chapter does not. The class is coded to produce a consistent space between the title and the text (or section) below the title; however when necessary \vspace{+ve or -ve} can be issued before the plain introductory text or section command to adjust this vertical space. The \showgrid documentclass option, if required, can be used to judge the the vertical spacing.

Instances of \subsubsection{...} and higher levels do not appear in the TOC, though they are included in the document. Other than the chapter headings, the rest of the item headings should be coded by the user manually with appropriate capitalization (title and sentence cases).

7.3 Dummy text and images

Users will be curious to see what their thesis/dissertation will look like quickly without using the actual texts and figures. The class comes loaded with necessary packages such as kantlipsum (for dummy text — philosophical prose paragraphs in English) and mwe ("minimal working examples" for dummy images). These will help visualize the whole document (fonts, spacings, and layout) with minimal effort, and this is a common practice among typesetters to use such dummy text and images. Commands from these packages are used in the thesis example (Sec. 3).

Commands like \kant[1] or \kant[4-8] will produce single or multiple dummy text paragraphs. Similarly, dummy images included in the mwe package can be accessed using their specific names and can be used as the image argument in the \includegraphics command, which means that the user need not use their images. Some of the commonly used examples images are: example-image, example-image-a, example-image-b, example-image-c, example-image-16x10, example-image-golden, example-image-plain, example-image-duck, example-image-empty, and example- grid-100x100pt. Refer to the documentation of these packages for further information.

7.4 Tables

Different kinds of tables, such as simple table without caption (tabular), table with caption (table), table with footnote (threeparttable), table spanning entire text width (tblr), table spanning multiple pages (longtable), and table in landscape page (pdflscape) can be coded following the documentation of respective packages, and no shortcuts were defined as they were not practical. Using booktabs package, the professional quality tables (Sec. 4.1) can be created. Examples of using these commands can be found in the example and/or extended example theses of the class. The guiding principle is to have a compact table based on the number of columns and avoiding excessive space between columns as well as font sizes not too small when more columns of information.

7.4.1 Tables with fewer columns

Compact tables with fewer columns are common and readily made by the common tabular environment. Where the columns will be based on the width of the widest entries and the columns will be naturally spaced and result in a compact table with the total width usually less than the textwidth. No special action is necessary to make these tables. Tables of less columns and narrower width need to be positioned on the page consistently. Either all of them left-justified or centered. Footnotes corresponding to the width of the table can be coded through the \multicolumn{no of cols}{lcr}{text}\\for single line items or \multicolumn{no of cols}{p{dimension}}{text} for footnotes that run like a paragraph. The width of the footnote is controlled by the amount of text or the dimension of the paragraph (refer to the "NDSU-Thesis-Extended.tex" for an example codes).

7.4.2 Full-width tables — tblr environment from tabularray package

When more columns present it the table, and can fit in the textwidth, it is better to code as automatic full-width tables. A quick and efficient method of creating tables that automatically span the entire textwidth is the use of tblr (short for top-bottom-left-right or tabularray) environment instead of the usual tabular inside the table environment. The tblr environment (from tabularray package) uses a special

column justification code X (default & options). This X code allots fixed column width based on the number of columns specified (default) and customizes individual columns' proportional width using coefficients with options. The `tblr` also takes the usual `l, c, r,` and `p` justification codes as well as the commands of `booktab` in the usual manner. The `tblr` environment is from the latest package and has several special features such as, specifying exclusive `math` mode column (no $ symbols required for individual items); SI units features; colored rows, cells, and lines; and so on (see `tabularray` package documentation). Footnotes with `tblr` environment can be coded easily with `tablenotes` environment.

7.5 Figures and schemes

The **figures** usually are pictures, photographs, drawings, maps, illustrations of samples, fields, instruments, structures, methods; graphs or plots of measurements, results; or anything graphically depicted to convey the thoughts. However, **schemes** are systematic plans for implementing an idea or concept, usually used to depict a process flow and the steps involved and often involve "arrows" connecting one step to the next. Examples of schemes are chemical process diagrams, sets of chemical reaction pathways, flowcharts (process and computer algorithms), electrical circuits, block diagrams connected by arrows, and so on.

It should be noted that the long format coding of figures using "`figure`" environment with `\includegraphics{...}` centering, resize, caption and labels is the direct approach and is always available to the users. Similarly, the schemes are coded using "`scheme`" environment. By default, the schemes are labeled as **Schematic** in their caption.

7.5.1 Shortcuts for figures and schemes — with direct and optional arguments

However, for convenience, a set of single command shortcuts, with five arguments plus one optional are defined. These commands specify (1) [optional] vertical placement of the caption (moving it up and down with respect to the bottom of the figure, especially for images with excessive or too less whitespace), (2) placement, (3) size factor, (4) input file, (5) caption, and (6) label were defined to produce figures (regular and landscape). The default caption's `aboveskip` is `0ex`, and this value can be changed using the optional argument. Following are examples of figure shortcuts for regular and landscape figures without and with the optional argument.

```
\myfig{ht}{0.7}{image1.jpg}{Caption for this regular figure}{fig:1}
\myfig[1.5ex]{ht}{0.7}{image1o.jpg}{Figure caption with placement option}{fig:1o}

\myfigls{p}{1.32}{image2.pdf}{Caption for this landscape figure}{fig:2ls}
\myfigls[2ex]{p}{1.31}{image3.pdf}{Landscape figure caption with placement option}{fig:3ls}
```

A similar set of shortcut commands, with optional (1) and other regular arguments (5) were coded for schemes, namely: `\mysch{...}`, `\mysch[...]{...}`, `\myschls{...}`, and `\myschls[...]{...}`.

These shortcuts (and regular float environments as well) are automatically included in the LOT, LOF, and LOSH that appear after the TOC. Sometimes, excessive spaces were observed above and below the figures and tables (floating elements) with respect to the text around. The use of vertical spacing (+ve or -ve; e.g., `\vspace{4pt}` and `\vspace{-6pt}`) around the floating elements can help in the adjustment of their placements. The vertical spacing commands can be issued before and after these environments (as required) to fix the spacing.

Coding tables, figures, and schemes will automatically create the LOT, LOF, and LOSH. A similar approach can be used for appendix figures (Sec. 7.9.3); however, for simplicity, appendix schemes (which can be coded as appendix figures) are not included in the class.

7.6 Captions

Because of the way spacing is handled, captions in `table` environments must appear at the top of the table, while captions in `figure` environments must appear at the bottom of the figure. NDSU style follows left-justification and bold font (only for the labels) for both captions. If you use both `\caption` and `\label`

commands in these environments, the \caption command must come before the \label command to ensure the environment is numbered correctly. The captions are coded in such a way that shorter ones are centered and longer ones are left-justified; however, as default the table captions are left-justified and can be changed, as outlined subsequently, to fit the requirement. The style of the caption can be basic or specific to the department, usually following the parent technical society's leading journal or style guide. The style of labeling (e.g., regular *vs* bold *vs* italic, naming: Fig. *vs* fig. *vs* Figure, etc.) can also be adopted from the leading journal. The various options available for caption using the `caption` package (already loaded) can be set through the \captionsetup{...} command. The common options are `position, skip, belowskip, aboveskip, font, labelfont, labelsep, singlelinecheck, format, justification,` and so on.

7.7 Equations

About handling equations, the NDSU's guidelines state "When coding equations, the guidelines call for the equation to be center-aligned, with the equation number aligned flush with the right margin." The strong suit of LaTeX is the professional manner it typesets the equations and mathematical elements. Show below is the distance formula that was defined and referred (eq. 1), which satisfies NDSU's guidelines:

$$\text{Distance formula:} \quad d = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2} \tag{1}$$

where, d is the distance; and x_1, y_1, x_2 and y_2 are the coordinates of the two points. The equations can be displayed (e.g., eq. 1) produced by \$\$...\$\$ or \[...\] or `equation` environment; and the inline as: $ax^2 + bx + c = 0$ produced by \$...\$ or \(...\). There exist several other commands are available to produce the equations through several packages (e.g., `align, array, eqnarray, gather, split`), and any imaginable mathematical information can be coded. Also, LaTeX supports a huge list of symbols (Refer: The Comprehensive LaTeX Symbol List; 18,150 symbols; 422 pages; `https://tug.ctan.org/info/symbols/comprehensive/symbols-a4.pdf`) that can be used in general text or equations.

7.7.1 Shortcuts for equations — properly spaced vertically

LaTeX engine sets an extra little vertical spacing around equations and non-textual elements (e.g., tables, figures) to make them stand out from the regular text; which is an expected and normal behavior. However, the NDSU's guidelines require no additional vertical spacing (same double line spacing) around equations. This additional spacing can be manually corrected by using a −ve \vspace{...} command before and after the elements as required (see Sec. 8.7 for details).

For convenient and automatic correct vertical spacing around equations, the following direct and starred versions of shortcut commands were coded for use in the class: \myeqn{ }, \myeqn*{ }, \myfraceqn{ }, \myfraceqn*{ }, \myalign{ }, \myalign*{ }, \myfracalign{ }, \myfracalign*{ }, \mygather{ }, \mygather*{ }, \myfracgather{ }, \myfracgather*{ }, \mydisp{ }, and \myfracdisp{ }. The arguments in these commands are the actual codes of the equation(s) without their environment as they were already included in these shortcuts (shown below).

Code	Output	Code	Output

`\myeqn{`
`E = m \times c^2`
`}`
	$E = m \times c^2 \quad (1.1)$	`\myalign*{`
		`E_i &= m_i \times c^2 \\`
		`y &= Ax + B`
		`}`
			$E_i = m_i \times c^2$
			$y = Ax + B$

As known, the direct versions of the shortcuts will produce the equation number while the * versions will not. A similar coding applies to all the aforementioned defined shortcuts and the produced output will fit well with proper vertical spacing with text around them. For other specialized equation environments, other requirements, or when not things do not fit well, the manual method of issuing the appropriate −ve \vspace{...} command can be followed.

7.8 References/bibliography

The two most common bibliography management systems (BMS) are BibLaTeX and BibTeX; the former being modern and highly versatile and the latter being simpler. BibLaTeX is recommended as the BMS of choice because of its direct usage, versatility, and future-proof capabilities. Reference or bibliography chapter or section can be combined into a stand-alone chapter (whole) or the reference listing can be included in all individual chapters. The bibliography listing in individual chapters sometimes desired by the user can be easily coded using the advanced BibLaTeX, which is also coded in the class. Both systems (individual or whole) use the same reference data in the form of `*.bib` file. The authors recommend using any of the systems by appropriately employing the system-specific commands. Various details of handling bibliography is presented in Sec. 8.8 and for bibliography compilation issues see Sec. 8.11.

7.8.1 Cite while you write (CWYW) using natbib

The `natbib` package for bibliography management is widely used and very stable and follows the CWYW paradigm. The package produces both author-year and numerical citations. The commands like `\citep{...}` citation in parenthesis and `\citet{...}` citation in running text are quite useful in particular. These commands will produce the following outputs, for example: "(Author et al., 2022)" and "Author et al. (2022) found ...". Different reference listing styles can be loaded both for BibLaTeX and BibTeX BMS.

7.9 Appendix

7.9.1 Single and multiple named appendices

If the disquisition includes a single appendix or multiple named appendices, one of two commands must be used to produce them. If the dissertation has only one appendix, use the `\appendix` command to begin it. This command generates an un-lettered APPENDIX chapter that can have sections, subsections, and so on, as well as tables, figures, and other elements.

If multiple named appendices are necessary, use the `\namedappendices{...}{...}` that can also contain other elements. Following are two examples of the named appendices:

```
\namedappendices}{A}{First named appendix title here}
\namedappendices}{B}{Second named appendix title here}
```

These appendix commands are optional but are required if the disquisition includes an appendix. The appendix must follow the unnumbered REFERENCES chapter. NDSU's guidelines on appendices only allow named appendices with letters (e.g., "APPENDIX A", "APPENDIX B"), while numerical or other styles ("APPENDIX 1", "APPENDIX 2", "APPENDIX I", "APPENDIX II", and so forth) are not accepted.

It is necessary to generate the listing of appendices in TOC up to the subsection level (A.1.1), similar to the regular chapters. To achieve this necessary codes were included in the class.

7.9.2 Appendix figures and tables

If the appendix contains figures or tables, use the `appendixfigure` and `appendixtable` environments to generate them. These special environments ensure that the figures and tables appear in separate tables that appear after the table of contents. The usual `figure` and `table` environments should not be used in the appendix. The same rules for centering, captions, and labels used in normal `figure` and `table` environments apply to `appendixfigure` and `appendixtable` environments. It should be noted that the manual coding of `appendixfigure` is also possible with basic commands and appendix schemes are not included in the class.

Similar to figures handled in the regular chapters (Sec. 7.5), for appendix figures as well, single command shortcuts dealing with appendix figures and appendix landscape figures with necessary arguments and one optional argument for caption vertical placement, were defined to produce the figures. Following are the examples of figure shortcuts for appendix regular, and landscape figures:

```
\myfigap{H}{0.6}{image_ap1.jpg}{Caption for this appendix regular figure}{fig:ap1}
\myfigap[12mm]{H}{0.6}{image_ap2.jpg}{Appendix landscape figure caption}{fig:ap2}

\myfigapls{p}{1.32}{image_ap3.pdf}{Caption for this appendix landscape figure}{f:ap3ls}
\myfigapls[1.5ex]{p}{1.33}{image_ap4.pdf}{Appendix landscape figure caption}{f:ap4ls}
```

7.9.3 Closing appendices and creating TOC, LOAT, and LOAF

In the class, the creation of LOAT and LOAF as well as their TOC entries requires special consideration. When the last appendix has at least one table and one figure, the TOC, LOAT, and LOAF will be automatically generated without intervention. However, when the last appendix does not have at least a table, or figure, or both (even though the previous appendices had them) the corresponding LOAT or LOAF and relevant TOC entries will not appear. The solution for the automatic creation of these items, irrespective of the contents of the last appendix is issuing the relevant commands such as `\closeappendixtable`, `\closeappendixfigure`, or `\closeappendices` in the overall code as the last command before `\end{document}` and after the last appendix code. Several scenarios occur due to the presence or absence of appendix tables and figures in the last or previous appendices and the last command (or) none to be used are presented in Table 3 for proper generation of LOAT and LOAF.

Table 3: Appendix closing for LOAT and LOAF generation — last command before `\end{document}`

Previous appendix(s) has/have	Last appendix has	Command to be used	Comment
No Table & Figure	No Table & Figure	None	LOAT and LOAF not generated
No Table & Figure	Only Table	None	Only LOAT auto generated
No Table & Figure	Only Figure	None	Only LOAF auto generated
No Table & Figure	Table & Figure	None	LOAT and LOAF auto generated
Only Table	Only Table	None	Only LOAT auto generated
Only Table	Only Figure	`\closeappendixtable`	LOAT and LOAF generated
Only Table	No Table or Figure	`\closeappendixtable`	Only LOAT generated
Only Figure	Only Table	`\closeappendixfigure`	LOAT and LOAF generated
Only Figure	Only Figure	None	Only LOAF auto generated
Only Figure	No Table or Figure	`\closeappendixfigure`	Only LOAF generated
Table & Figure	Only Table*	`\closeappendixfigure`	LOAT and LOAF generated
Table & Figure	Only Figure*	`\closeappendixtable`	LOAT and LOAF generated
Table & Figure	No Table or Figure	`\closeappendices`	LOAT and LOAF generated

* The command `\closeappendices` can also be used instead

The aim is to generate the LOAT or LOAF or both as coded in the appendices avoiding blank lists with only headers or no lists altogether. The other items of the TOC, namely, LOT, LOF, LOSH, LOA, and LOS are automatically generated based on the presence or absence of these floats/items coded in the chapters or prefatory material.

8 Additional Information I — Special Commands

8.1 Chapter styles

Two styles namely, regular- and paper-styled chapters are generally followed. The regular is a traditional style where the whole thesis/dissertation is considered as a single document where individual chapters exclusively deal with aspects like introduction, literature review, methods, results, discussion or results and discussion, references, and appendices reflecting all studies carried in the research on these individual chapters. Even though this style produces a consolidated document and is solid in its own merit, which ties all research

aspects of the study together in corresponding chapters, a good deal of rewriting will be necessary from the authors if they want to publish the contents as individual peer-reviewed journal articles.

The paper-styled chapters are stand-alone chapters complete with all sections (abstract, introduction, literature review, ..., references) and are the modern trend. In this style, some amount of repetition among chapters is unavoidable (especially in methods, analysis, and references). However, as the chapters are already in paper-style, it is very easy to format them to suit the requirement of any peer-reviewed journal for submission. It is also possible to have individual chapter references (BibLaTeX) or a combined reference chapter (both BibTeX and BibLaTeX). With LaTeX it is easy to create stand-alone papers with references for submission from a paper-styled disquisition with a combined reference chapter. As outlined earlier, the commands that start these chapters are `\myheading{...}` or `\mypaperheading{2 args}` (Sec. 7.2). It is a good idea to consult the advisor before committing to these styles, for they are different and substantial rewriting is involved to switch back and forth.

8.2 Advanced options in documentclass

8.2.1 Font size

The general font sizes used with thesis are 10, 11, and 12 points and they vary with the selected font. The available options (any of these used) are:

```
\documentclass[10pt (or) 11pt (or) 12pt]{ndsu-thesis-2022}
```

The default was set as `12pt`.

8.2.2 Auto-numbered, chapter-numbered, and unnumbered styles

The three possible NDSU thesis styles with options included are: (i) Auto-numbered [default option] — where chapters, sections, subsections, and so on will be numbered; (ii) Chapter-numbered [chapternumber] — where only chapters are numbered, while sections, subsections, and so on will not be numbered; and (iii) Unnumbered [nonumber] — where all headings such as chapters, sections, subsections, and so on will not be numbered.

As the default is the numbered style, the chapter-numbered and unnumbered styles were produced by the "chapternumber" and "nonumber" options respectively as:

```
\documentclass[chapternumber (or) nonumber]{ndsu-thesis-2022}
```

The default was the "Auto-numbered" style. These options will have their specific effect on the numbering scheme of the tables and figures.

8.2.3 Paragraph text justification

Based on their preference students can follow fully-justified (with hyphenated words and word wrapping) or unjustified (no word breaking but right margin ragged, aka left-justified). As the default is justified, the left-justified passages were produced by the `[nojustify]` option. For justified style, nothing needs to be specified. NDSU approves both styles.

8.2.4 Draft and display document frames

You can use the `[draft]` option to place the disquisition into draft mode. In this mode, margin overflows are marked with a heavy black box to draw your attention to them; additionally, images are replaced by a placeholder (Fig. 2a). If you import other packages in your disquisition, they may also change their behavior when in draft mode.

The `[showframe]` option (based on `geometry` package) produces a frame around the text area which can be used to check how the text aligns with the margins (left, right, top, and bottom; see figure above). The illustration alongside displays the result of these options showing the overflowing text, bottom margin frame, right margin frame, margin notes frames, and the overflow heavy black box. The default behavior is these options were inactive.

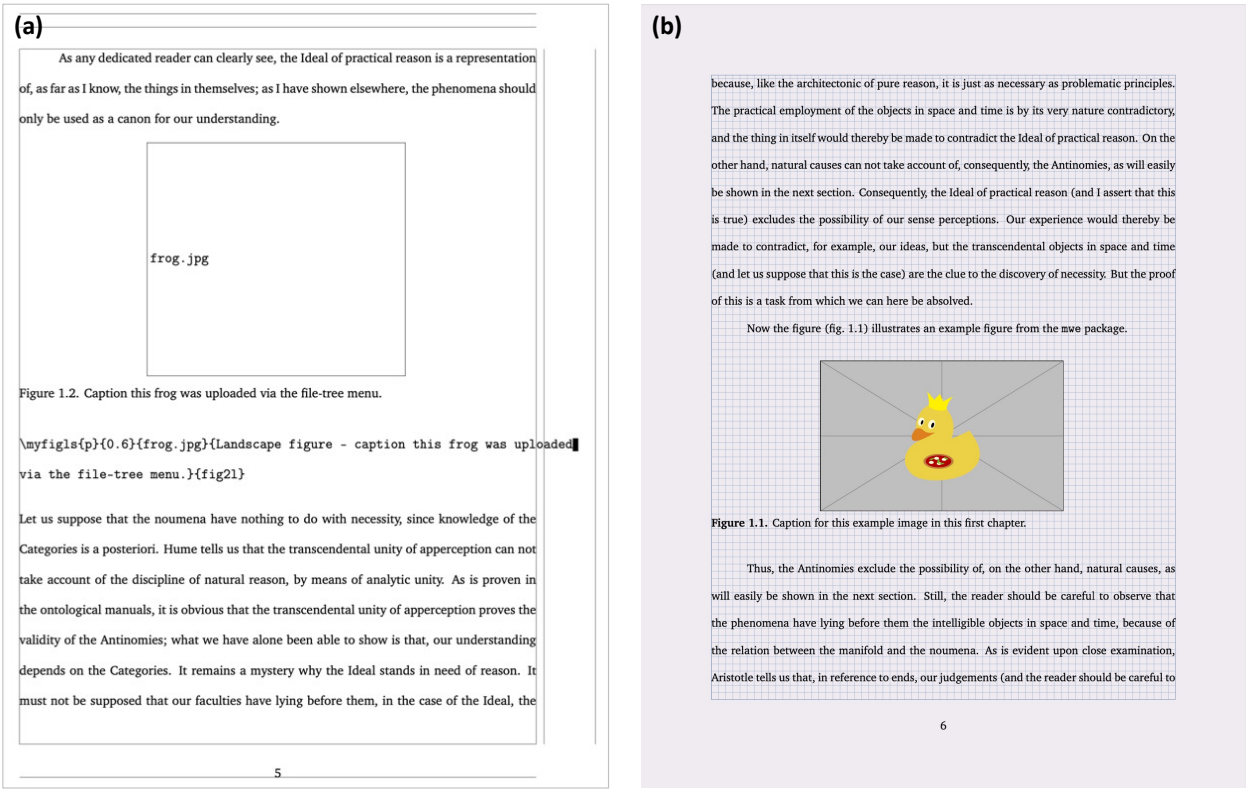


Figure 2: Use of (a) `draft` and `showframe` options in `documentclass` producing image placeholder for quicker processing, document frames, and margin overflows, and (b) use of `showgrid` option displaying grids of 0.1 in squares spacing to help visualize the alignment (vertical and horizontal) concerns of elements.

8.2.5 Grids display

While alignment and spacing of elements will be automatically handled by LaTeX, the NDSU's guidelines deviate a bit from the LaTeX engine, especially texts around non-textual elements, viz. equations, tables, and figures. Although the normal behavior of LaTeX introduces a little extra space around non-textual elements, NDSU's guideline dictates a consistent double-spacing that is followed in the regular text should be around the non-textual elements. This additional spacing can be corrected by using a −ve `\vspace{...}` command before and after the elements as required (see Sec. 8.7 for details).

To visualize better the spacing around textual and non-textual elements a documentclass `[showgrid]` option was made available (Fig. 2b). The grid was displayed underneath the elements covering the body (`textwidth` × `text height`) and the lines were spaced at 0.1 in on both vertical and horizontal directions and the whole page is rendered on a light gray background. It can be seen that the basic text line vertical spacing is about 0.4 in (4 grid lines between the baselines of consecutive lines of text; Fig. 2b). This vertical spacing (0.4 in) should be carried throughout the document with some deviation among captions of tables and figures, table data rows, and program listings. After fixing the spacing concerns, using `\vspace{...}` commands, the `showgrid` option should be removed for the final output. By default this option is inactive.

8.2.6 Fonts

The following font options `[bookman, charter, gentium, kpfonts, libertine, mathdesign, mathptmx, mlmodern, newcent, newpx, newtx, palatino, tgtermes, times, tgbonum, tgpagella, tgschola, utopia, clearsans, cmbright, firasans, helvet, kurier,lxfonts, sansmathfonts]` (both serif and san serif fonts) are loaded and compatible with the class, and anyone can be used. It is also possible to use several other fonts from "The LaTeX Font Catalog" web resource (`https://tug.org/FontCatalogue/`) and

adding the code given in the "Usage" section in the preamble of the main document `*.tex` file. The default was LaTeX computer modern font. Users are urged to check the NDSU-approved fonts and select those that resemble them and use them with appropriate font sizes.

8.3 Line numbers for the whole document

Sometimes using line numbers will be helpful while communicating with the advisor or others, where specific locations of the document can be pointed to. Line numbers are generated using the package `lineno`, which is coded into the class, by the following command:

```
\linenumbers
```

This command can be issued at the beginning or at any point, and numbers will appear in the left margin after the command. Of course, this command should be removed or commented on while finalizing the thesis.

8.4 Whole document text spacing

NDSU mandates double-spacing for the body paragraphs' text. A default double-spacing setting in MS Word produces 23 lines per page while LaTeX `\doublespacing` produces 27 lines. Any of these lines per page defaults in the respective systems are acceptable. To recreate the line spacing of 23 lines per page in LaTeX was reproduced through `\renewcommand\myspacing{1.9}` in the preamble, which was also set as default in the class, and this spacing is automatically applied to the whole document.

Other values of `\myspacing` will produce other spacings but should be consulted before using them. While developing the document and working with drafts, it will be efficient to reduce the `\myspacing` value to less than 1.0 (e.g., 0.75) to generate a compact version for reviewing and draft printing, and can be restored to 1.9 for final disquisition in correct line spacing.

8.5 Tables: Advanced commands

8.5.1 Table row spacing and fonts

The table contents row spacing can be adjusted, if desired, using `\renewcommand\arraystretch}{decimal}` before `tabular` and `\SetTblrInner{rowsep=length}` before `tbrl` environment inside the table environment. For example, a value of 1.75 for the arraystretch will be similar to the double line spacing; and without this command, the row spacing will be single line spacing. Table footnotes can be added through `tablenotes` environment placed inside `table` environment after the `tabular` and `resize` blocks. The NDSU template font footnote is the regular font; however, the font size can be altered by selecting the standard sizes (e.g., `\footnotesize`, `\small`) within the `tablenotes` environment to match the content of the table.

8.5.2 Landscape tables

When a table has more columns of information, the most common solution is the landscape orientation which is achieved through `landscape` environment by enclosing the `table` codes (which may contain other elements) inside `landscape` environment block (between `\begin{landscape}` and `\end{landscape}`). With landscape usually the placement option will be [p] and the whole width should be set around 1.32 times the `\columnwidth`, or adjusted suitably to leave acceptable margins all around.

8.5.3 Resizing tables for full-width

Sometimes while fitting more contents into a table, the table extends beyond the allowed margins. Therefore for the best control of tables, especially with more columns, a combination of `\resizebox` (resizing the entire table - mostly for scaling down) and `\tabcolsep` (maintaining the column separation space) works the best. Thus, the command `\resizebox{\columnwidth}{!}` makes the table to span the entire text width of the page. This will expand or shrink the contents of the table to fit the entire width. It should be fine with the fonts shrink to fit the width, but will not be when the fonts enlarge (especially when the table is small

and has only a few columns). In such situations, the space between the columns can be adjusted using the `\tabcolsep{...}` command, where increased spacing reduces the font size and *vice versa*. Thus, by using these commands (including `tblr`) in combination the tables and the font size can be scaled down to fit the page with the proper font size.

8.5.4 Long tables

Sometimes, there will be a need to create long tables (multiple pages spanning tables) in the landscape orientation to accommodate several columns that will not fit in regular paper orientation. This landscape long tables can be logically obtained by enclosing the long table codes within `landscape` environment block as described earlier. It should be noted that, unlike regular tables, long table source code involves several components (main caption, running header [abbreviated caption], running footer [usually the word "continued..."], and main footnote). Refer to the "`NDSU-Thesis-Extended.tex`" for an example code.

8.5.5 Landscape long tables

Combining the `landscape` and `longtable` environments the landscape long tables can be created logically. Refer to the "`NDSU-Thesis-Extended.tex`" for an example.

8.6 Figures: Advanced commands

8.6.1 Figures and schemes in separate folder

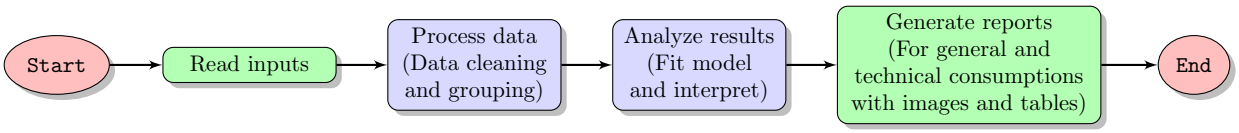
Several images (figures, schemes, graphs, drawings, and pictures) were used while developing a thesis or paper. It will be convenient to store all these images in a subfolder to reduce the clutter. The following command should be issued in the preamble indicating the name of the subfolder (e.g., `figures`) relative to the main "`tex`" file as:

```
\graphicspath{{./figures/}}
```

The type of image files applicable are: `jpg, pdf, png,` and `eps`. It is also possible to give an absolute path to the images folder in the above command.

8.6.2 Flowchart - tikz package

Flowcharts, schemes, geometrical diagrams, circuit diagrams, and data visualization graphs are common in technical writing. These elements can be created elsewhere and included in the dissertation as an image or high-quality (vector graphics) can be created using codes directly. An example of a schematic flowchart created through Ti*k*Z code is shown below:



Schematic 1: A high-quality schematic flowchart created using the Ti*k*Z package.

The Ti*k*Z package, based on TEX is an excellent and elaborate package (manual having > 1300 pages) that can be used for creating high-quality graphics that serve the needs of any technical documentation (Example Fig. 1). Going through the manual of Ti*k*Z and the gallery will give information on the package capabilities and how that can be used in the dissertation.

8.6.3 Subfigures

Multiple figures (subfigures) under a common caption can be handled through `subfig` package. The subfigures can be individually sized, captioned, labeled, and referenced. The sub-caption numbering is "alphabetic" by default (holds 26 — and for more subfigures, other options are available) and will be automatically generated. The number of images that occupy a single row can be readily coded with commands, such as `\subfloat{...}`, `\hspace{...}`, and newline (`\\`). Refer to the accompanied "NDSU-Thesis-Extended" document for instruction and examples.

8.6.4 Landscape subfigures

Similar to landscape long tables, subfigures that span multiple pages can be enclosed in `landscape` environment block to produce landscape multiple pages of subfigures with the same figure number. Refer to the "`NDSU-Thesis-Extended.tex`" for example code.

8.6.5 Multiple page subfigures

Sometimes several subfigures running through multiple pages need to be used in the thesis. These are similar to long tables that span several pages. General captions of the set of subfigures fitting in a page are coded with regular `\caption{...}` command, which can be individually controlled. These captions may be the same or abbreviated. Subfigures and their sub-captions were created through `\subfloat[...]{...}` command of `subfig` package. The optional argument of `\subfloat` is the individual subfigure caption and the regular argument is the `\includegraphics` command with its usual optional argument. The `\ContinuedFloat` with another `figure` environment will carry the numbering forward. When the number of subfigures exceeds the number of alphabets (26), the numbering system should be switched to numeric. Refer to the "`NDSU-Thesis-Extended.tex`" for example code showing multiple page subfigures.

8.7 Spacing adjustment around non-textual elements

Usually, the spacing around the non-textual elements produced by LaTeX will be good and based on typography principles. The environments that create these elements (e.g., tables, figures, schemes, equations) automatically supply an additional space to set the elements apart from the regular text and this is the expected and correct behavior. However, sometimes additional space will appear above or below these elements, which may be the result of fitting the elements with respect to others of the whole chapter. However, the spacing around the non-textual elements can be altered by one or any combination of the following to produce a consistent spacing around the non-textual elements:

- The blank line coded, usually left between paragraphs, might create additional space before the element (e.g.,`equation`, `align`) and that can be removed to reduce the space above the element. For equations the defined shortcuts can be used to produce the correct vertical spacing (see Sec. 7.7.1).
- Proper use of vertical spacing `\vspace{...}` command with negative spacing (e.g., `\vspace{-3ex}`) can able to correct the blank space above the element. This can also be used when a blank line was issued to separate the regular text from the element. Positive vertical space can also be issued as needed.
- In figures and schemes, the space above the caption (the space between the bottom of the image and the top of the caption) can be controlled by using the optional argument of the `myfig, myfigls, mysch, myschls, myfigap` and `myfigapls` commands (see Sec. 7.5.1). This optional argument was specifically developed to address this caption placement issue. This may be required only for necessary adjustments as the default (without option) will work well in most cases.

8.8 Reference handling using BibLaTeX

The BibLaTeX package provides advanced bibliographic facilities for use with LaTeX. Good working knowledge in LaTeX should be sufficient to design new bibliography and citation styles using this system. The BibLaTeX works with the backend (program) "biber", which is used to process the bibliography data files

and then performs all sorting, label generation, and many more operations. This package also supports subdivided bibliographies, multiple bibliographies within one document, customizable sorting, multiple bibliographies with different sorting, customizable labels, and bibliographies may be subdivided into parts and/or segmented by topics. Users are urged to refer to the package documentation for various features (`https://ctan.org/pkg/biblatex?lang=en`).

8.8.1 Commands, cite, bibliography generation and files handling

The basic commands that invoke the BibLaTeX system, which has to be issued in the preamble, are:

```
\usepackage[style=apa,natbib=true,backend=biber]{biblatex}
\addbibresource{name-of-bib-file.bib}
```

In the above BibLaTeX command's option the bibliography information processing program "biber" was used as a backend program. The options also load "apa" style and "natbib" handling (allowing the `\citep{...}` and `\citet{...}` commands in BibLaTeX) as an example. The documentation and other resources (`http://tug.ctan.org/info/biblatex-cheatsheet/biblatex-cheatsheet.pdf`) may be referred for common options and details of the package. The compatible styles used with BibLaTeX are: `numeric`, `numeric-comp`, `alphabetic`, `authoryear`, `authoryear-icomp`, `authortitle`, `verbose`, `reading`, `draft`, `apa`, `chem-acs`, `chem-angew`, `chem-biochem`, `chem-rsc`, `ieee`, `mla`, `musuos`, `nature`, `nejm`, `phys`, `science`,, `oscola`, and so on (new styles are made available with every updates). Users can use an appropriate style to match their specialization style guide.

With the package and bib file(s) loaded and processed, the reference listing can be generated anywhere in the document by issuing:

```
\printbibliography[heading=bibintoc,title=REFERENCES]
```

The options "`heading=bibintoc`" makes an unnumbered chapter and includes the heading in the TOC and "`title=REFERENCES`" changes the default title from BIBLIOGRAPHY to REFERENCES. The `\printbibliography` command when issued at the end of the chapters will create a "combined" REFERENCES chapter.

8.8.2 Automatic individual (multiple) and whole document reference listing using BibLaTeX

Sometimes it is desired to have a bibliography listing in every chapter, as the last unnumbered section, especially with the paper-style chapters. These individual chapter reference listings can be invoked by the option `[chapterrefs]` in documentclass. Individual chapters' bibliography can be easily processed using BibLaTeX rather than BibTeX through `refsection` environment.

New commands such as `\checkBeginRefsection` and `\checkEndRefsection` can be considered as an environment that immediately follows each chapter title and encloses the chapter contents (similar to `refsection` environment) — as shown subsequently. At the end, usually before appendices, the `\checkMakeCombinedReferences` command was once issued.

```
\mypaperheading{...}{...} % chapter n
\checkBeginRefsection
    ... Chapter's text starting with abstract, sections/subsections, and so on,
    with citations using \citep{...} and \citet{...} or other citation commands ...
\checkEndRefsection
\mypaperheading{...}{...} %chapter n+1
\checkBeginRefsection
    ... Chapter's text starting with abstract, sections/subsections, and so on,
    with citations using \citep{...} and \citet{...} or other citation commands ...
\checkEndRefsection
... Other chapters' codes follow a similar arrangement
\checkMakeCombinedReferences % Given at the end of chapters
... Appendices codes ...
```

A combination of these commands — automatically checks the desired type of reference listing — and produces the individual chapter reference listings (with `[chapterrefs]` documentclass option) or the whole document unnumbered reference chapter (without the aforementioned option - default). Following these automatic commands of BibLaTeX will be the most efficient way of handling the bibliography. Examples of the usage of these commands will be seen in the included "`Sample-thesis-IncludeOnly`" folder files. Needless to mention these are convenient commands developed for the class and the desired behavior can also be achieved by usual direct commands.

8.9 Reference handling using BibTeX

8.9.1 BibTeX

The compatible styles (`*.bst`) with `natbib` and NDSU class that work with standard LaTeX installation are: `abbrvnat, agsm, agu, apalike, apalike2, authordate1, authordate3, cell, chicago, chicagoa, dcu, dinat, IEEEtran (family; numerical styles), kluwer, plainnat, rusnat, unsrtnat`, and so on (new styles are made available with every updates). For other styles, users can able to download the specific style (`*.bst`) files and have them in the local folder. As `natbib` is an optional bibliography system, it was not coded in the class, and to use `natbib` the following code should be in the preamble:

```
\usepackage[sort&compress]{natbib}
\citestyle{arms} % agms, agu, arms, egu, cospar, dcu, kluwer, plain, nature
```

It is convenient to load the `natbib` package with minimal options, as shown above, and choose predefined `\citestyle{option}` options producing several styles defined in the package.

8.9.2 Bibliography generation and files handling

The two basic commands that are required to implement BibTeX system are:

```
\bibliographystyle{style} % See list of styles (Sec.11.1.1)
\bibliography{name-of-bib-file}
```

However, a single new command "`\makebib`" (direct shortcut with no arguments) was coded, replacing the above commands, setting up the bibliography style and *.bib file arguments as:

```
\newcommand{\makebib{\biblio{style}{name-of-bib-file}}
```

The above command is conveniently placed at the beginning of the preamble where the users replace the style and bibliography arguments as inputs. Then, simply issuing the `\makebib` will generate the references

listing based on the style and bib file input in the above command. The "style" of bibliography (`*.bst`) entries (typically `plainnat` or `apalike`), is controlled by the first argument; the user is referred to the BibTeX manual for formatting details and other available styles, such as those provided by the peer-reviewed journals related to the specialization. The "name" used in the second argument must be the same as the name of the bibliography (`*.bib`) file, but with the extension removed. Once correct citation commands (`\citep{...}` and/or `\citet{...}`) are issued following CWYW, the citation with proper reference number or entry will appear in the text and listings in the proper style (based on *.bst) will be generated. The above shortcut generates an unnumbered chapter with the title REFERENCES (accepted by NDSU) and also a corresponding TOC entry.

These commands (or equivalent commands if the user uses a different bibliography management system) are optional but are required if the disquisition includes references. The basic bibliography citation command is `\cite{...}` and that works as well.

8.10 Specialization specific bibliography — Examples of ASABE and IEEE

The bibliography styles to be followed in thesis/dissertation will be based on the parent department and the major technical society the department subscribes to in general. For example, the NDUS's "Agricultural and Biosystems Engineering" department's major technical society is The American Society of Agricultural and Biological Engineers (ASABE), and the NDSU's "Electrical and Computer Engineering" department's technical society is The Institute of Electrical and Electronics Engineers (IEEE). The two ways of making the bibliography are to use BibLaTeX or BibTeX.

The ASABE style journal references can be reproduced using `\usepackage[style=apa, natbib=true]{biblatex}`. For `IEEEtran` styles with BibLaTeX use `\usepackage[style=ieee]{biblatex}`. With BibTeX `*.bst` files and `\citestyle{...}` commands are available to create the style of reference followed in various departments (see Sec. 8.8 for details).

8.11 Bibliography compilation issues

The common issues [and proposed solution] while working with bibliographies, especially in combination with `natbib` include:

- The basic principle usually gets violated is that the LaTeX inputs (`tex, bib, or others`) require only the ASCII characters. Anything that disregards this principle will have issues during compilation. Presence of extraneous characters (unprintable and formatting) in the `*.bib` file, which comes while copying a formatted non-ASCII text, stalls the compilation. Command line or terminal commands or online tools can be used to identify the non-ASCII characters (e.g., `https://pages.cs.wisc.edu/~markm/ascii.html`, `https://onlineasciitools.com/validate-ascii`) [remove non-ASCII text from `*.bib` file]
- BibTeX contains several types of entries (e.g. article, book, misc, etc) and each has its own "Required" and "Optional" fields. Not filling the required field will throw an error [familiarize with these fields (`https://en.wikipedia.org/wiki/BibTeX`) and ensure supplying all the required fields or change to suitable different entry that is less restrictive (e.g., misc)]
- Another most common issue with bibliography entries is "duplicate entries." These are entries with repeated citation "keys" (non-unique) and stop the compilation with a clear error message [check and remove the duplicate/multiple entries]
- The bib files should not contain regular text such as notes. All items should belong to allowed database entries and fields [check and remove the text entries or comment them out using %]
- Proper title case will not appear in the output (e.g., proper nouns like country names) even though things may seem right in `*.bib` file [use additional curly braces {...} to enclose the desired title case items or the letters]
- Accented characters, usually found in authors' names, might cause issues [correct use of codes to produce accented characters should be used and it is a good idea to enclose them with additional braces (e.g., é, ò, ê, ö, ç, ñ, ł, Ł, æ, å, through `{\'e}`, `{\`o}`, `{\^e}`, `{\"o}`, `{\c c}`, `{\~n}`, `{\l}`, `{\L}`, `{\ae}`, and `{\aa}`)]

- Proper italics will not show in the output (*Scientific names* of animals and plants; e.g., *Homo sapiens, Zea mays*) [use `\emph{...}` around the entries in the `*.bib` file]
- Proper formatting of URLs with wrapping content and clickable links does not appear [use `\url{...}` command in the `*.bib` files entries that have the URLs]
- Outputs not formatted according to the thesis/journal requirement [select the correct BibLaTeX style option or `bst` file that matches most of the requirements and modify the code to suit our requirement might sometimes require — most often only a few alterations are needed and have the file in the same folder as `*.bib`]
- New bibliography styles that are not listed (Sec. 11.1.1) might not run properly, mostly because of not having the corresponding BibLaTeX style or `*.bst` in the system [download style files and have it in the system/local folder]
- Some numerical styles (e.g., IEEEtran family) will not work when the `natbib` was set to author-year format [optional arguments of `natbib` package or arguments of `\citestyle{}` command should be made compatible to the numerical styles (e.g., "numbers" or "plain" in their respective commands) — so a combination of chosen `*.bst` and `citestyle option` is the key to create the references listing in the correct format]
- While trying different styles, compilation stops even for compatible styles [this is a common phenomenon and could be solved with an understanding of how BibTeX and LaTeX resolves references by creating several auxiliary files (e.g., *.aux, *.toc, *.log, *.out) including *.bbl — as contents of these files were referred from unsuccessful compilation, removing all these files leaving the source (`*.tex`) and recompiling with the compatible style and options will restore and regenerate the output. Thus, starting with only a clean source will work and regenerate the necessary files including the output, this strategy will work in other situations of compiling issues as well — however, is not always necessary].

8.12 Proper development of bibliography bib file

- Bib files should not be considered a dumping ground for bibliography codes that were usually not looked at for correctness, unlike the regular document source codes. This sometimes proves to be a serious mistake and stops compilation or produces strange outputs or major errors.
- The bib file, therefore, should be developed step-by-step carefully and each entry should be checked for correctness (only with ASCII characters and allowed equivalent LaTeX commands for non-ASCII characters) and appropriateness (required and optional fields in bibliography entry).
- Bib files are automatically generated by other reference management software (e.g., Zotero) for a given set of references, while they are helpful and provide a good starting point, are sometimes sources of compilation errors. These software may include "abstract" fields as well in the bib file, which are long and become sources of several unintended non-ASCII characters. These superfluous fields may be deleted so that the bib file is compact. Some of these software may include modern entries and fields that may be recognized by BibLaTeX but not included in BibTeX. Though it may be possible to create simpler and cleaner bib files, it is a good idea to check the generated bib file "line-by-line" for correctness.
- It was found that "Google Scholar" generated BibTeX entries worked well in developing the bib file. These entries usually generate logical naming of the keys and valid LaTeX commands for non-ASCII characters (especially international accented characters). Even in these entries checking the bib entries is always a good idea (e.g., use of capital letters, and emphasis).
- Common errors include:
  - Extraneous non-ASCII characters (see Sec. 8.11 first bullet);
  - % sign - which is an innocent symbol, but with LaTeX anything after will be considered as a comment so to produce % we need to use \%;
  - On a similar note, we have a set of reserved symbols (&, %, $, {, }, , _, #, and so on) that carry a special meaning and should not be used (without "\" preceding; e.g., \&, \%, \$, and so on) loosely and expect a logical outcome;

- Every field (author, year, journal, etc.) should end with a comma (but the last one) - in a good bib file, just remove one comma and see the effect - which will teach us how a small thing will wreck the whole compilation;
- Unconventional fields (though created by other software) should be replaced by the correct ones (Wikipedia BibTeX), for example, date instead of the year will not work;
- Special symbols like degrees, copyright, and others commonly used in other systems can be coded in LaTeX as regular commands - and that command version of these symbols should be used in a bib or tex file;
- Duplicate entries.
- Unmatched braces.
- Several types of BibTeX entries (`https://en.wikipedia.org/wiki/BibTeX#Basic_structure`; e.g., `article, book, inproceedings, masterthesis, phdthesis, misc`, and so on) with their specific *Required fields* and *Optional fields*. Missing a required field (though generated by other resources) will be a mistake and will suspend compilation. The entry *misc* does not contain any required field and can be used to fit odd entries.
- The foreign accented characters (e.g., é, ò, ê, ö, ç, ñ, ł, Ł, æ, å, and so on, that are created by `\'e, \`o, \^e, \"o, \c c, \~n, \l, \L, \ae, \aa` LaTeX commands) (check the LaTeX cheat sheet and learn how to code them - all start with followed by some ASCII symbols or characters and the input character that receives the accent. As a practice try to have these accented characters in the tex file. If it runs there then that can be inserted into bib.

- While building your bib file add a couple of entries and check how they compile. Don't go for the whole 120 entries (just to throw a good number).
- To visualize the reference listing of all the entries of the `*.bib`file issue the `\nocite{*}` command. After the correctness of the entries is checked and fixed, the command may be removed and the listing of only cited references will appear — nothing more nothing less.
- Further, remember the use of enclosing capital letters, especially in titles, for example, NDSU, Argentina to get the capitals right from bib files. Similarly the use of `\emph{...}` for technical names in bib files for italicized output (e.g., *Zea mays* for corn) - otherwise they come out in normal font.
- It is a good idea while working with bib entries or in the main text, the liberal use of the `comment` environment, from the `comment` package, in the main text helps to check problematic bib entries and also produces efficient compilation.

8.13 Chemical symbols

Chemical symbols and chemical equations can be coded easily in a natural manner using the `\ch{...}` command using the `chemformula` package — rather than using the math mode. The following chemicals: H_2O, H_2SO_4, CrO_4^{2-}, $[AgCl_2]^-$, $(NH_4)_2S$, $^{227}_{90}Th^+$, and $KCr(SO_4)_2 \cdot 12\,H_2O$ were coded through: `\ch{H2O}`, `\ch{H2SO4}`, `\ch{CrO4^2-}`, `\ch{[AgCl2]-}`, `\ch{(NH4)2S}`, `\ch{^{227}_{90}Th+}`, and `\ch{KCr(SO4)2 * 12 H2O}`, respectively.

`\ch{A + B ->[a] C}`	gives	$A + B \xrightarrow{a} C$
`\ch{N2 + 3 H2 -> 2 NH3}`	gives	$N_2 + 3\,H_2 \longrightarrow 2\,NH_3$

Refer to `chemformula` documentation for more options and details. It should be noted that there are other packages available for coding the chemicals and chemical equations, which are not included in the class but users can use them through `\usepackage{...}` command.

8.14 Individual or combine reference listing

The two types of reference listings are in the individual chapters added that end or a combined reference listing for all chapters as a standalone unnumbered chapter.

8.15 Annotation commands

While developing the dissertation the text undergoes several revisions and suggestions will be provided by the advisor and colleagues. To make suggestions as well as to present the carried out revisions colored annotations will be helpful to draw users' attention quickly. Therefore, special annotation commands for highlighting, new text, deleted text, replaced text, and notes were defined in the class. These annotation features can be used by the student and the advisor reviewing the dissertation draft. The `ulem` and `todonotes` packages were used to develop these commands, and their documentation may be referred to for customization. All the annotations can be searched and deleted before submission, and these processes can be even automated by search expressions (e.g., regular expression). The annotation commands with usage are shown subsequently:

`\hl{Highlight}` gives: Highlight. This will be regular text.
`\nt{Test new text.}` gives: Test new text. This will be regular text.
`\dt{Deleted text.}` gives: ~~Deleted text.~~ This will be regular text.
`\rt{The text to be deleted}{Which will be replaced by this!}` gives:
~~The text to be deleted~~Which will be replaced by this! This will be regular text again.

While using the above annotation commands, except for `\nt{...}`, enclosing a cited reference commands (`\citep{...}` or `\citet{...}`) use `\mbox {...}` around the cited references. For example, `\dt{...text...\mbox{\citep{daly2010natural}} ...text...}` gives: ~~...text... (Daly, 2010) ...text ...~~

`\notes{To Do notes - for interactive communication!}` (also the shortcut `\td{...}`) gives:

To Do notes - for interactive communication!

8.16 Clever reference — cross-referencing items and labels

Referring to items automatically using the defined labels is a common activity in LaTeX and is called cross-reference. Although there are basic commands available to refer (e.g., fig. `\ref{label}`), the use of `cleveref` package is an efficient way to achieve this task. This package enhances LaTeX's cross-referencing to automatically detect the "type" of the item cross-referenced (e.g., equation, section, tables, figures, schemes, etc.) based on the context of the cross-reference. This means a single command of `\cref{label}` or `\Cref{label}` with the label will produce the correct output (e.g., fig. 1.1, eq. 3, Figure 1.1, Equation 3, etc.). Refer to this package for more details and customization. However, `cleveref` commands will not work with the appendix tables and appendix figures only, where the basic commands (`\ref{...}`) should be used.

8.17 Chapters as individual files

When the length of chapters gets long it will be better managed into individual `*.tex` files. Then the thesis file will become a collection of such individual files and will be highly compact. The individual chapters are coded using either of these commands:

```
\input{filename.tex}
\include{filename}
```

The `\input{filename.tex}` imports the codes from the `filename.tex` into the main file at the location where this command was issued. This is equivalent to typing all the code commands from the individual file into the main file. The `\include{filename}` issues a `\clearpage` before and after inserting the contents and had better speed than the `\input{filename.tex}` command. With such commands in place, it is possible to compile only the chapter the user wants to work on by commenting others, and this approach saves unnecessary compilation or reduces compilation times.

This procedure helps in focusing on the "work at hand" and enhances writing quality and productivity. It should be noted that the entire code of the document is "there" but only hidden from compiling and the comment commands can be removed or "commented" to produce the entire document at any time for the final use. One drawback of this approach is that all the numbering (e.g. chapter, section, tables, figures) will

be reset and start from the beginning and may not represent the final whole document's actual numbering. Just to address this situation the concept of `includeonly` was developed (see Sec. 8.18).

Furthermore, these individual chapter files can be stored under a folder (similar to `graphicspath`. For example, use the command below that declares the path of the folder (relative to the default directory) where the source codes of all chapters (`*.tex`) can be kept inside the folder of the default directory (e.g. `mychapters`).

```
\chapterspath{./mychapters/}
```

With this method the default directory (or project folder) will contain only one project tex file (e.g., `main.tex`), which calls the other chapters and figures from the respective folders, and other resources necessary for building the output (`cls, bib, bst, ...`). This way all the figures and chapters will be "tugged away" and promote better file organization (refer to `sample thesis includeOnly` project included with the class). In such system of storing the files separately, only the main project file can be compiled, which uses the codes of chapters in other folder, to generate the output, and the individual chapters cannot be compiled directly as the code does not contain the `documentclass`, prefatory material, and `document` environment — which is obvious.

8.18 Chapters using "includeonly" method — efficient working and compiling

LaTeX allows to develop the document piece-by-piece (e.g., individual chapters, section, and even paragraphs) currently worked on. One way of doing this is to use the comments package's `comment` environment. The portion of the source code, however long, enclosed between `\begin{comment}` and `\end{comment}` will be excluded from compilation and output. This will be often convenient than commenting individual lines and paragraphs using % character.

On the same token, applying two comment blocks, above and below the current chunk of code (e.g., chapter, section, and so on), obviously leaving the `\begin{document}` and `\end{document}` lines, the only portion of the code will be compiled and displayed. The `\end{comment}` of the top block and the `\begin{comment}` of the end block can be moved as required to compile and output different portions of the code for display and inspection. An alternative method is to replace the bottom comment block with the direct `\tend` or other variations (temporary ending command; see Sec. 8.19). This method will end the document and only display the compiled output after the first comment block and before the temporary end command.

As mentioned earlier, commenting out chapters (direct codes or included or input chapters) will reset the numbering system, which affects the natural order. This issue was solved by the method of "`includeonly`," where the numbering system is preserved, irrespective of commenting out the included chapters, and the approach of using this along with a main project file is as follows. The `\includeonly` command coded in the preamble has all the chapters but the last (in this case `appendixB`). The last chapter should be added in the form of `\input` command to suppress the blank last page created by `\include` command as shown.

First run

```
... Preamble ...
\includeonly{
chapter1,
chapter2,
chapter3,
chapter4,
appendixA
}
...
\begin{document}
...
\include{chapter1}
\include{chapter2}
\include{chapter3}
\include{chapter4}
\include{appendixA}
\input{appendixB.tex}
...
\closeappendices
\end{document}
```

Second and subsequent runs

```
... Preamble ...
\includeonly{
chapter1,
%chapter2,
%chapter3,
chapter4,
appendixA
}
...
\begin{document}
...
\include{chapter1}
\include{chapter2}
\include{chapter3}
\include{chapter4}
\include{appendixA}
\input{appendixB.tex}
...
\closeappendices
\end{document}
```

Notes

The number of chapters/files in the `includeonly{ }` should match the files used in the `\include{...}` command. All chapter lines of code being active in the first run will create the `*.tex` files. In the second run shown only chapters 1, 4, and appendix A will be output. Any or all chapters in the `includeonly{ }` can be made inactive or active in any subsequent runs and corresponding output will be generated. The total thesis TOC and other prefatory contents will always be generated irrespective of the selection of chapters.

For the initial run all lines of code with `includeonly` and `include` of the chapters should be active, which will produce the necessary working files (*.aux) for all chapters. In the later runs only the required chapters in the `includeonly` portion of the code can be kept active (other chapters commented, but "`include`" chapters always kept active — refer to the additional example `sample thesis includeOnly` project in the class bundle) and will produce the output of those active chapters only — with all contents correctly numbered. Another advanced method is to use `subfiles`, where individual chapters can be directly compiled.

8.19 Temporary ending

While reviewing/revising a large document, it will be efficient to compile only the chapter/section that was currently working. The temporary ending command coded in the class, when issued will generate a shorter document while the rest of the document will be ignored (Table 4). As this command only makes a temporary ending, all the source codes from the beginning until the command will appear in the output. To focus and work on a specific chapter/section/paragraph and so on, a combination of the "includeonly" (Sec. 8.18) and/or `comment` environment should be used with the temporary ending. Therefore, using this method, it is possible to work on a single paragraph of source text.

Table 4: Temporary ending commands for different document scenarios and their usage

Document scenario	Command	Outcomes
Single/multiple files	`\tend`	Ends document - should not have `[chapterrefs]` option in documentclass and no reference listing produced
Single/multiple files, BibTeX & who. refs.	`\tendbt`	Ends document - makes reference listing using BibTeX style
Single/multiple files, BibLaTeX & who. refs.	`\tendblt`	Ends document - makes reference listing using BibLaTeX resource, produce chapter individual reference listing with `[chapterrefs]` option otherwise a single whole reference so far

Note: who. refs. - whole document single reference chapter.

Since we deal with source codes having different features (BibTeX *vs* BibLaTeX, individual chapter *vs* whole document reference, single *vs* multiple source files), based on the users' choice, several temporary ending commands developed (Table 4) with usage. Based on the type these commands will end the document with or without a reference listing. These commands have instructions to appropriately close the respective environments (e.g., `refsection, document`), and users should ensure that the respective environment is active before these commands. It should be noted that the temporary ending commands for BibTeX and BibLaTeX should not be applied interchangeably.

8.20 Defining and using specific commands, environments, and packages

As it is not possible to write a class to satisfy the specific requirements of the several departments of NDSU, most of the major features as outlined in this document were coded into the NDSU class, and the users can add necessary features in their source code specific to their requirement. This approach gives flexibility making the class compact and useful. Mathematics, physics, chemistry, literature, etc. departments may use specific symbols and environments that other departments (e.g., agriculture) do not for their thesis. This means that based on the requirement, if the packages are not already loaded in the class, the necessary packages can be loaded in the source files and they work with the class. Another aspect is the bibliography style and management, which varies with different departments. To deal with this the necessary style files (`*.bst`) should be kept in the same folder as `*.tex` or the appropriate path specified in the source code.

Specific packages (e.g., bibliography management), new commands (shortcuts), and new environments (e.g., theorem, proof, etc.,) can be included in the preamble. These specific items are best left to individual users, as others may not need this — hence they are not included in the class deliberately.

8.21 Thesis to journal article conversion for submission

A few adjustments are necessary to convert the thesis chapters into journal articles. The commands that are specific to the class (e.g., \myfig{}, \mysch{}, etc.) will not be known to the journal LaTeX template. When the corresponding `newcommand` codes (made of basic commands) as shown in Table 5 against the class shortcut below were inserted in the template preamble it will compile. As the shortcuts are convenient and reduce the amount of code typed (Don't repeat yourself — DRY method), it will be better to insert the preamble and retain the thesis code than to replace it with basic commands at all occurrences.

Table 5: Converting thesis chapters to journal articles — preamble information to be added to journal template source code.

Shortcut example commands in thesis (Refer Sec. 7.5.1)	**Command to be inserted in the preamble for journal articles**

`\myfig[0.4cm]`
`{h!}{1.0}{fig1.png}`
`{Regular figure caption}`
`{fig:1}`
	`\newcommand{\myfig}[6][0ex]{`
	`\begin{figure}[#2]`
	`\centering`
	`\captionsetup{aboveskip=#1 plus 2pt minus 2pt, belowskip=0pt}`
	`\includegraphics[width=#3\textwidth]{#4}`
	`\caption{#5}`
	`\label{#6}`
	`\end{figure}`
	`}`

`\myfigls[0.5cm]`
`{ht}{0.8}{fig2.pdf}`
`{Landscape figure caption}`
`{figls:2}`
	`\newcommand{\myfigls}[6][0ex]{`
	`\begin{landscape}`
	`\begin{figure}[#2]`
	`\centering`
	`\captionsetup{aboveskip=#1 plus 2pt min?us 2pt, belowskip=0pt}`
	`\includegraphics[width=#3\textwidth]{#4}`
	`\caption{#5}`
	`\label{#6}`
	`\end{figure}`
	`\end{landscape}`
	`}`

Note: Also to be followed with scheme shortcuts when employed

The compatibility issue will not be there with the tables for no shortcuts were defined in the class and all table codes used the basic commands from the respective packages. Also, the heading commands (\myheading{} and \mypaperheading{}) are specific to the thesis class (see Sec. 7.2) and will not generally work with the journal template. However, their different arguments can be extracted and used in the commands specific to the journal template. Similarly the code from the appendices such as, `appendixtable` and `appendixfigure` environments should be replaced by the basic `table` and `figure` environments, respectively, in the article template. In general, paper will not have schematics and those are usually coded as figures. Needless to mention that the NDSU class-specific front matter commands that may not appear in individual chapters such as, `author, date, progdeptchoice, department, cchair, cmember(a-d), approvaldate, approver, listofabbreviations, listofsymbols`, and so on, will not work in the journal template; but the content of the arguments can be copied and utilized in the appropriate journal template commands.

It may be also necessary to include the missing packages in the template, which were used in the thesis class. The missing packages can be identified from the "`Undefined control sequence`" error messages from the command that stop the compilation (e.g., using \cref{} without loading the `cleveref` package). Of course, the template-specific commands should be used while developing journal articles. With these adjustments, the thesis code easily transitions to the journal articles. It is hoped that with the working knowledge of LaTeX previously obtained and/or gathered thus far the students can able to handle what is required to convert the thesis chapters into journal articles' source code utilizing the specific journal

templates.

9 Additional Information II — Some Tips For Customization

9.1 General suggestions

NDSU Graduate School Formatting Guidelines (`https://www.ndsu.edu/sites/default/files/2021-09/Format-Guidelines-2021.pdf`) should be adhered to and the guidelines to be referred for various aspects of developing the work. Following are some of the general suggestions while developing the thesis/dissertation:

- All content-related decisions should be made by the student, advisor, and committee, and should follow any rules or conventions established within your program, department, or field.
- Students are highly encouraged to follow the prevalent style manual of the discipline (e.g., MLA, APA, Chicago, IEEE, etc.) while formatting the thesis (especially formatting of tables, figures, and other non-textual elements). In the instances where the Graduate School guidelines contradict the style manual for your discipline, the former takes precedence. However, if a generic style is applied consistently throughout all items it will also be approved. During format review, a consistent application of one style is accepted. In short, consistency is KEY.
- Paper or regular thesis/dissertation chapters (two possible styles) should follow NDSU format guidelines consistently across all chapters and use the prevalent style manual of the discipline.
- References, tables, and figures should follow the most appropriate style manual of the discipline. Some have the caption centered and set in bold font.
- A footnote should be included if the chapter is co-authored (an example of this is in NDSU guidelines) and including publication information in the footnote or in the Acknowledgments section is recommended.
- The general recommendation about spacing between items and their surrounding non-textual content (equations, figures, tables, quotes, pseudocode, etc.) is to set a consistent spacing between items and their surrounding content as seen in most academic publications.
- Table (and figure) captions should be in the same font size as general text; however, text inside tables and footnotes may be in smaller font sizes as needed to fit the item within the page margins.
- NDSU guidelines have a number of very specific rules (e.g., Table of Contents and Prefatory List formatting, abstract word count, headings, body text paragraphs, etc.); however, they give a lot of flexibility for what is not covered, and give the student (and committee) control of the written content.
- It should be noted that LaTeX is a vast program with numerous facilities and resources that students can use while developing their thesis/dissertation and improving the document quality. All regular LaTeX commands and features work well with the NDSU thesis class.
- The tables and figures are "floating" items, hence may not appear at the location where they were coded by the users. The LaTeX algorithm will decide the best place to display them and this behavior can be adjusted/forced by float specifiers combinations (e.g., `[h, t, p, b, !, H]`). As the floats cannot be broken, usually it will be displayed on the top of the next page. With proper application of these float specifiers and moving the location of the float source code (moving text around), the desired effect can be achieved.
- With `tblr` environment, the `H` is known to create increased row spacing (possible compatibility issue between `tabularray` and `float` packages). Therefore, `[h]` or `[h!]` should be instead to maintain the intended row spacing. This issue was not found with `tabular` environment.
- Several of the user-developed shortcut commands utilized in the class can be achieved using the LaTeX direct commands — as the shortcuts are simply `\newcommand` with arguments defined in the class using direct LaTeX commands.

9.2 Limitations of the class

- *Shortcuts for tables*: Unlike figure environment, table vary a lot (e.g., number of columns and rows) hence not possible to develop shortcuts (such as `\myfig{}`). Therefore, no shortcuts were coded in the class and the users should go for the basic command using the `\table` environment.
- *Citations in captions*: This means using `\citep{...}` or `\citet{...}` or `\cite{...}` inside the `\caption{...}` argument of tables and figures is not supported. However, the output of the cites can be hard-coded (after noting the output outside of the caption) as a workaround. It should be noted that cite commands are known to work in captions of other classes.
- *Limited packages loaded*: Only limited packages that are thought to be useful for students and cater to most thesis/dissertations, in general, are included in the class. Therefore for special needs, users need to include the respective packages in the preamble.

9.3 NDSU resources and information for disquisition writers

NDSU website	**For more information about:**
Graduate School > Current Students	Graduate School policy, deadlines, forms, graduation. URL: `https://www.ndsu.edu/gradschool/current_students`
Graduate School > Dissertations, Theses, and Papers	Disquisition policies, formatting guidelines, templates, a guide to using the templates, submission procedures, publication and delayed release information. URL: `https://www.ndsu.edu/gradschool/current_students/graduation/papers_theses_dissertations`
Center for Writers	Writing consultations, writing workshops, disquisition boot camps, writing resources on site and online. URL: `https://www.ndsu.edu/cfwriters/`
Learning and Applied Innovation Center (LAIC)	Thesis formatting workshops. Help with our template. Help with using Microsoft Word and other software applications. Walk-in consulting service in Quentin Burdick Building 150C, or schedule an in-person or virtual appointment with their thesis formatting specialist. Note: The LAIC does not consult on guidelines nor conduct reviews of your formatting. See them for technical help carrying out formatting functions. URL: `https://www.ndsu.edu/it/help/laic/`
Formatting Tutorial Videos	Hosted on the GPS Academy YouTube Channel. "Navigating the Review Process" workshop recording and "Word Crash Course" videos on In-Paragraph Formatting; Styles; Section Breaks and Page Numbers; Table of Contents; Tables and Figures; Landscape Pages and More about Tables; Template Overview. URL: `https://youtube.com/playlist?list=PLWKsN3lW50IexOpLRkNjh2HDuVKp3XjFH&si=Cksb4ZlFK3X1uCCh`

Links accessed on 16 Nov. 2023

9.4 Voice of the TEX and LATEX developers!

It is interesting to know what the original developers of TEX and LATEX have to say about this system of document preparation. Following are the quotes from the developers about how people feel, perceive, and use the system for their documentation needs.

> "*I never expected TEX to be the universal thing that people would turn to for the quick-and-dirty stuff. I always thought of it as something that you turned to if you cared enough to send the very best.*" — Donald Knuth (Developer of TEX [on which LATEX is based])

> "*LATEX is easy to use — if you're one of the 2 % of the population who thinks logically and can read an instruction manual. The other 98 % of the population would find it very hard or impossible to use.*" — Leslie Lamport (Developer of LATEX)

It is safe to assume that students who came this far should have "cared enough" to improve the quality of their thesis/dissertation, and some who may think they are in the 98 % might discover that they have better logical skills than they originally believed. Furthermore, using LATEX for the documentation needs (e.g., thesis/dissertation, paper, report, book, letter, CV, and so on) should be considered a useful skill in itself that students can pick up and use throughout their career.

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