STEM Dissertation Template - Word Format

Complete template for STEM dissertations (Engineering, Physics, Chemistry, Computer Science, Mathematics, Biology). Formatted for Microsoft Word with equation/figure-heavy content.

TITLE PAGE

[Page number: i - Roman numerals]

[TITLE OF DISSERTATION IN TITLE CASE]

A Dissertation

Submitted to the Graduate Faculty of

[University Name]

in Partial Fulfillment of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY

Department: [Department Name]

Major: [Your Major]

by

[Your Full Name]

[Month Year]

Committee:

[Chair Name], Major Professor
[Member Name]
[Member Name]
[Member Name]
[External Member Name]

COPYRIGHT PAGE

[Page number: ii]

ABSTRACT

[Page number: iii]

Abstract

[250-350 words summarizing: problem statement, methodology, key results, conclusions, significance. Can include equations if essential. Double-spaced.]

Keywords: [5-7 technical keywords]

DEDICATION (Optional)

[Page number: iv]

[Centered]

To [dedication]

ACKNOWLEDGMENTS

[Page number: v]

Acknowledgments

[Thank advisor, committee, funding sources (NSF, NIH, etc. with grant numbers), lab members, collaborators, family. 1-2 pages.]

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LIST OF SYMBOLS

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List of Symbols

Symbol	Description	Units
	[Description]	[units]
	[Description]	[units]
	[Description]	[units]
ΔT	Temperature difference	K
	[Description]	[units]

Symbol	Description	Units
	Wavelength	nm
	[Description]	[units]
	Density	kg/m^3
	[Description]	[units]
[Continue alphabetically, Greek then Roman]		

LIST OF ABBREVIATIONS

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List of Abbreviations

Abbreviation	Full Term
ANOVA	Analysis of Variance
CPU	Central Processing Unit
DFT	Density Functional Theory
FEM	Finite Element Method
HPLC	High-Performance Liquid Chromatography
ML	Machine Learning
PCR	Polymerase Chain Reaction
SEM	Scanning Electron Microscopy
[Continue alphabetically]	

CHAPTER 1: INTRODUCTION

[Start Arabic numbering: Page 1]

CHAPTER 1

INTRODUCTION

1.1 Background and Motivation

[Opening paragraph establishes broad context and significance]

[Field] has experienced significant advances in recent years, particularly in [area] (Author et al., Year). These developments have enabled [what they've enabled], leading to improvements in [application areas]. However, despite this progress, several challenges remain.

Current state of the field. [Describe current understanding, technology, or methods]

Problem context. [Explain why the problem you're addressing matters]

The motivation for this research stems from [specific gap or need]. Current approaches suffer from [limitations], which constrains [application or understanding]. Addressing this problem is important because [significance].

1.2 Problem Statement

This dissertation addresses the following problem: [clear, specific statement of the problem].

Specific challenges:

1. [Challenge 1 with brief explanation]
2. [Challenge 2]
3. [Challenge 3]

These challenges have limited [what's been limited]. A solution would enable [what it would enable].

1.3 Research Objectives

The primary objective of this research is to [main objective].

Specific objectives:

1. To develop [objective 1]
2. To investigate [objective 2]
3. To analyze [objective 3]
4. To validate [objective 4]

Research questions:

- RQ1: [Specific research question]
- RQ2: [Specific research question]
- RQ3: [Specific research question]

Hypotheses: (if applicable)

- H1: [Hypothesis statement]
- H2: [Hypothesis statement]

1.4 Contributions

This dissertation makes the following contributions:

1. [Contribution 1]: [Brief description of theoretical/methodological/experimental contribution]

2. [Contribution 2]: [Description]

3. [Contribution 3]: [Description]

Publications: Portions of this work have been published in:

- [Citation for published paper 1]
- [Citation for published paper 2]

1.5 Dissertation Organization

The remainder of this dissertation is organized as follows:

Chapter 2 reviews relevant literature on [topics].

Chapter 3 presents the theoretical framework and mathematical formulation.

Chapter 4 describes the experimental methodology and procedures.

Chapter 5 presents results from [experiments/simulations/analyses].

Chapter 6 discusses findings and their implications.

Chapter 7 summarizes conclusions and suggests future research directions.

CHAPTER 2: LITERATURE REVIEW

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature relevant to [topic]. The review is organized into [number] sections covering: (a) [topic 1], (b) [topic 2], and (c) [topic 3]. The chapter concludes by identifying gaps addressed by this research.

2.2 [Topic Area 1]

[Organize chronologically, methodologically, or thematically]

2.2.1 [Subtopic]

Early work in [area] focused on [approach]. Smith et al. (Year) demonstrated that [finding], while Jones and Brown (Year) showed [finding].

Key findings from literature:

- [Finding 1] (Citations)
- [Finding 2] (Citations)
- [Finding 3] (Citations)

2.2.2 [Subtopic]

More recent advances have addressed [what]. Author (Year) proposed [method/theory], achieving [result]. This work was extended by Author et al. (Year), who [contribution].

Comparison of approaches:

Table 2.1. Comparison of existing methods

Method	Advantages	Limitations	Reference
[Method 1]	[advantages]	[limitations]	(Citation)
[Method 2]	[advantages]	[limitations]	(Citation)
[Method 3]	[advantages]	[limitations]	(Citation)

2.3 [Topic Area 2]

[Continue comprehensive review]

2.4 Summary and Research Gaps

The literature reviewed reveals [synthesis]. However, several gaps remain:

Gap 1: [Description of gap]

Gap 2: [Description of gap]

Gap 3: [Description of gap]

This dissertation addresses these gaps by [how your work fills gaps].

CHAPTER 3: THEORETICAL FRAMEWORK

CHAPTER 3

THEORETICAL FRAMEWORK

3.1 Mathematical Formulation

This section presents the mathematical foundation for [system/model/algorithm].

3.1.1 Problem Formulation

Consider a system where [description]. The governing equation is:

[INSERT EQUATION using Word Equation Editor]

$F = ma$ [Example - use proper equation formatting]

where F is force (N), m is mass (kg), and a is acceleration (m/s^2).

Tip for Word: Use Insert → Equation for all mathematical expressions. Number equations on right: (3.1), (3.2), etc.

3.1.2 Derivation

Starting from first principles, [explanation of derivation].

From Equation (3.1), we can derive:

[INSERT EQUATION] (3.2)

Substituting Equation (3.2) into [another equation] yields:

[INSERT EQUATION] (3.3)

Detailed derivations are provided in Appendix A.

3.2 Model Development

3.2.1 System Model

Figure 3.1 shows the system architecture.

Figure 3.1. [Descriptive title]

[INSERT FIGURE - centered, with caption below]

Note: [Explanation if needed]

3.2.2 Algorithm Description

The proposed algorithm consists of the following steps:

Algorithm 1: [Algorithm Name]

```
Input: [parameters]
Output: [results]
1: Initialize [variables]
2: For i = 1 to n do
3:     [Operation]
4:     If [condition] then
5:         [Action]
6:     End if
7: End for
8: Return [output]
```

Tip for Word: Use Courier New font, 10pt for code/algorithms, with gray background shading.

3.2.3 Complexity Analysis

The time complexity of Algorithm 1 is $O(n^2)$, where n is [parameter]. The space complexity is $O(n)$.

3.3 Assumptions and Constraints

Assumptions:

1. [Assumption 1 with justification]
2. [Assumption 2]
3. [Assumption 3]

Constraints:

1. [Constraint 1]
2. [Constraint 2]

Validity of assumptions: These assumptions are valid for [conditions under which they hold].

CHAPTER 4: METHODOLOGY

CHAPTER 4

METHODOLOGY

4.1 Experimental Design

4.1.1 Overview

This research employs [experimental/computational/simulation-based] approach to validate [what you're validating].

Figure 4.1. Experimental design flowchart

[INSERT FLOWCHART showing experimental procedure]

4.1.2 Design Parameters

Table 4.1. Experimental conditions

Parameter	Value	Range	Units
[Parameter 1]	[value]	[range]	[units]
[Parameter 2]	[value]	[range]	[units]
[Parameter 3]	[value]	[range]	[units]

4.2 Materials and Equipment

4.2.1 Materials

[List all materials with specifications, purity, suppliers]

- [Material 1]: [specifications] (Supplier, catalog #)
- [Material 2]: [specifications] (Supplier, catalog #)

4.2.2 Equipment

Table 4.2. Equipment specifications

Equipment	Model	Specifications	Purpose
[Equipment 1]	[Model]	[Specs]	[Purpose]
[Equipment 2]	[Model]	[Specs]	[Purpose]

Figure 4.2. Experimental setup

[INSERT LABELED DIAGRAM of apparatus]

4.3 Procedures

4.3.1 Sample Preparation

1. [Detailed step 1]
2. [Detailed step 2 - be specific about quantities, times, temperatures]
3. [Step 3]

Safety considerations: [Any hazards and precautions taken]

4.3.2 Measurement Protocol

[Detailed description of measurement procedures]

Each experiment was repeated $n =$ [number] times to ensure reproducibility. Measurements were taken at [intervals] for [duration].

4.3.3 Quality Control

- Calibration: [Procedure]
- Blanks/Controls: [What controls used]
- Standards: [Reference standards]

4.4 Data Collection and Analysis

4.4.1 Data Acquisition

Data were collected using [instrument/software] at [sampling rate]. Raw data were stored in [format] for subsequent analysis.

4.4.2 Data Processing

Raw data underwent the following processing:

1. [Processing step 1]
2. [Filtering/smoothing: method used]
3. [Normalization: procedure]

4.4.3 Statistical Analysis

Statistical analyses were performed using [software, version]. The following tests were conducted:

- Descriptive statistics: mean, standard deviation, standard error

- [Specific test 1]: To determine [purpose]
- [Specific test 2]: To compare [groups]

Significance was set at $p < 0.05$. Results are reported as mean ± standard deviation unless otherwise noted.

4.4.4 Error Analysis

Sources of error include:

- [Error source 1]: Estimated contribution [percentage]
-
-

Total uncertainty was calculated using [error propagation method].

CHAPTER 5: RESULTS

CHAPTER 5

RESULTS

[Present results objectively. Interpretation goes in Chapter 6.]

5.1 [Experiment/Analysis 1]

5.1.1 [Specific Result]

Figure 5.1 shows [what it shows].

Figure 5.1. [Descriptive title including conditions]

[INSERT FIGURE - high quality graph/plot]

Note: Error bars represent standard deviation (n = [number]).

Table 5.1. [Title]

Condition	Result 1	Result 2	Result 3
[Condition A]	[value±error]	[value±error]	[value±error]
[Condition B]	[value±error]	[value±error]	[value±error]

As shown in Figure 5.1, [objective description of what's observed]. The measured [parameter] was [value ± uncertainty] [units], compared to the theoretical value of [value] [units].

5.1.2 Statistical Analysis

Statistical analysis revealed [finding] (t-test, $p < 0.001$). ANOVA indicated significant differences between [groups] ($F(2,27) = 15.3$, $p < 0.001$).

5.2 [Experiment/Analysis 2]

[Continue presenting results with figures, tables, and statistical analyses]

5.2.1 Effect of [Parameter]

Figure 5.2 illustrates the effect of [parameter] on [response].

[Present results systematically, organized by research questions or experimental conditions]

5.3 [Experiment/Analysis 3]

[Continue]

5.3.1 Comparison with Simulation

Figure 5.3 compares experimental results with simulation predictions.

Figure 5.3. Experimental vs. simulation results

[INSERT COMPARISON PLOT]

The experimental results show good agreement with simulation ($R^2 = 0.95$). The mean absolute error was [value]%.

CHAPTER 6: DISCUSSION

CHAPTER 6

DISCUSSION

6.1 Interpretation of Results

6.1.1 [Finding 1]

The results presented in Section 5.1 demonstrate [interpretation]. This finding can be explained by [explanation with reference to theory/mechanism].

The observed [phenomenon] is consistent with [theoretical prediction/previous work] (Citation). Specifically, [detailed interpretation].

Physical mechanism: [Explain the underlying physics/chemistry/biology]

6.1.2 [Finding 2]

[Continue interpreting each major finding]

6.2 Comparison with Literature

6.2.1 Agreement with Previous Work

The results are consistent with Author et al. (Year), who reported [similar finding]. However, the current work extends this by [how you extend it].

6.2.2 Discrepancies

Some results differ from Author (Year). Specifically, [what differs]. This discrepancy may be due to [methodological differences/different conditions/improved measurement technique].

6.3 Implications

6.3.1 Theoretical Implications

These findings have implications for understanding [phenomenon]. The results suggest that [theoretical insight], which [how it advances theory].

6.3.2 Practical Implications

The demonstrated [capability/performance] indicates potential applications in [areas]. Specifically, [practical application].

6.3.3 Design Guidelines

Based on these findings, the following design guidelines are proposed:

1. [Guideline 1]
2. [Guideline 2]
3. [Guideline 3]

6.4 Limitations

6.4.1 Experimental Limitations

Several limitations should be noted:

- [Limitation 1 and impact]
- [Limitation 2 and impact]
- [Limitation 3 and impact]

6.4.2 Model Limitations

The model assumes [assumptions], which may not hold when [conditions]. Future work should address [how to address].

CHAPTER 7: CONCLUSIONS AND FUTURE WORK

CHAPTER 7

CONCLUSIONS AND FUTURE WORK

7.1 Summary of Findings

This dissertation addressed [problem statement]. The major findings are:

1. [Finding 1 with quantitative result if applicable]
2. [Finding 2]
3. [Finding 3]

These findings demonstrate that [overall conclusion].

7.2 Contributions

This research makes the following contributions:

Scientific contributions: - [Contribution to knowledge/understanding] - [New insight or discovery]

Technical contributions: - [New method/algorithm/technique] - [Performance improvement: quantify]

Practical contributions: - [Application potential] - [Design guidelines]

7.3 Future Research Directions

Several directions for future research are recommended:

Short-term: - [Immediate extension 1] - [Immediate extension 2]

Long-term: - [Longer-term direction 1] - [Longer-term direction 2]

Open questions: - [Question raised by this work] - [Unresolved issue]

REFERENCES

REFERENCES

[Format according to field convention: IEEE, ACS, AIP, etc.]

[Numbered citations typical for STEM - use citation manager]

IEEE Style Example:

[1] A. B. Smith, C. D. Jones, and E. F. Brown, "Title of paper," *Journal Name*, vol. 10, no. 5, pp. 123-145, Month Year.

[2] A. B. Smith, *Book Title*, 2nd ed. City, State: Publisher, Year.

[3] A. B. Smith et al., "Title," in *Proc. Conference Name*, City, State, Year, pp. 1-10.

[Continue numbered list for all references - typical STEM dissertation: 100-200 references]

APPENDIX A: DERIVATIONS

APPENDIX A

DERIVATIONS

A.1 Derivation of Equation (3.5)

[Detailed mathematical derivation]

Starting from:

[EQUATION]

[Step-by-step derivation with explanations]

A.2 Proof of Theorem 1

[Mathematical proofs]

APPENDIX B: EXPERIMENTAL DATA

APPENDIX B

EXPERIMENTAL DATA

B.1 Raw Data from Experiment 1

[Tables of complete raw data]

B.2 Calibration Data

[Calibration curves, standards data]

APPENDIX C: CODE LISTINGS

APPENDIX C

CODE LISTINGS

C.1 Simulation Code

[Program listings with comments]

`[Use monospace font, proper indentation]`

C.2 Data Analysis Scripts

[Analysis code]

APPENDIX D: SUPPLEMENTARY FIGURES

APPENDIX D

SUPPLEMENTARY FIGURES

[Additional figures supporting but not essential to main text]

FORMATTING CHECKLIST FOR WORD

General

- ☐ 12-pt Times New Roman (or Arial for engineering)
- ☐ Double-spaced body text (single-space for captions, tables)
- ☐ 1-inch margins
- ☐ Page numbers: Roman (front matter), Arabic (body)

Equations

- ☐ Use Word Equation Editor (Insert → Equation)
- ☐ Number equations on right margin: (3.1), (3.2)
- ☐ Define all variables after first use
- ☐ Italicize variables, not units or functions

Figures

- ☐ High resolution (300+ dpi)
- ☐ Number as Chapter.Figure: Figure 3.1
- ☐ Caption below figure, in smaller font
- ☐ Reference all figures in text before they appear
- ☐ Vector graphics preferred (SVG, EPS)

Tables

- ☐ Number as Chapter.Table: Table 3.1
- ☐ Caption above table
- ☐ Units in column headers
- ☐ Align numbers by decimal point
- ☐ Source note below if needed

Citations

- ☐ Use consistent style (IEEE, ACS, AIP, etc.)
- ☐ Use reference manager (Mendeley, Zotero, EndNote)
- ☐ Number citations consecutively [1], [2], etc.
- ☐ All references cited in text

TYPICAL LENGTH

STEM PhD Dissertation: 150-250 pages

- Introduction: 10-15 pages
- Literature Review: 25-40 pages
- Theory: 20-35 pages
- Methodology: 20-30 pages
- Results: 30-50 pages (figure-heavy)
- Discussion: 15-25 pages
- Conclusions: 10-15 pages
- Appendices: 20-50 pages

Template Complete. Use equation editor for all math. Good luck with your research!