This document provides a general guideline for preparing reports. Students will have to modify/improve the content for their own class/laboratory reports. It is highly encouraged to solicit feedback on their reports from peers, industry mentors and faculty advisors.

I. PURPOSE

The goal of a technical report is to describe explicitly and briefly the following:

1. The specific problem(s) and/or question(s) addressed
2. The data collected
3. How the data was collected
4. How the data was analyzed
5. How the results of this data analysis were used to draw conclusions and/or recommendations

More importantly, preparing and writing a report is one of the most important ways in which an engineer communicates ideas to managers, other engineers, and customers. Technical reports present facts and conclusions about your designs and other projects. Typically, a technical report includes research about technical concepts as well as graphical depictions of designs and data.

II. STRUCTURE

In order to describe the items mentioned in the previous section, reports are usually divided in the following sections:

1. Title
   It should clearly and accurately describe the experiment/project. It should also contain the name of the author(s), the date the data was collected, as well as the course name.

2. Abstract
   This section provides the reader with a valid and brief description of the content. The abstract should not be a summary of the report, but rather a clear description of the project scope, the major findings and what conclusions and recommendations were drawn. The objective is to allow the reader to get a quick understanding of the report’s purpose and content. After reading the abstract, the reader usually makes the decision on whether or not to read the full document.
3. **Introduction**
   In all reports a background is desirable in order to introduce the problem to the reader. This section should also contain the reasons why the students are undertaking it. In order to accomplish these goals, information about previous work is usually presented in this section. A hypothesis is usually introduced in this section.

4. **Theory and Analysis**
   This section is included in order to provide a clear and succinct explanation of the principles, laws and equations used. Definitions of new terms must be defined in this section. It is recommended to include diagrams that expedite the understanding of how the problem is approach. This part is not meant to be a copy of what is included in the books and other literature, but rather a quick guide for the reader on what analysis is being conducted.

5. **Experimental Procedures**
   All apparatus and materials used in the project must be described here. The instrument description includes the type, manufacturer, ranges, accuracy, calibration status and identification number if applicable. Usually, a figure showing all the components positions and connections is used. The location and its environmental conditions are also reported here. The procedure used must also be described in this section. This includes material preparation, measurements prior to testing, stabilization periods, the duration and the frequency of the data collection. Any precaution and controlling condition should be also included. It must also be stated whether the experiment is following or not a corresponding standard code.

6. **Results & Discussion**
   A summary of the findings is included in this section. This summary is usually supported with tables and graphical representations. Differences between data collected and theoretical predictions must be highlighted and explained. It is important to mention if the conditions of the experiment changed during the data collection. This section does not include all the data collected, it is meant to be a summary. Usually, only one data set is analyzed through all steps as an example. Raw data and extensive tables should be included in the appendix section. If a graph is presented, the data used is not presented in a table as it is repetitive. Be sure that the data is organized accordingly to the factors that are being tested in the experiments.

7. **Conclusions & Recommendations**
   This section puts emphasis on the accuracy and importance of the results and how they compared to the hypothesis formulated in section 3. Differences greater than the experimental error are explained by stating the shortcomings of the theories presented in section 4. Please consider that the hypothesis may or may not be supported by the experiment results. Conclusions must be drawn from numerical results presented in section 6, even if errors have been made. Based on these ideas, further hypotheses can be created in the form of recommendations.
8. **Acknowledgements**
In case the report was done with major collaborations from people or institutions, they should be included in this section. Ideas, advising, materials and funding are all considered collaborations. This section usually appears on theses, journal articles and company reports.

9. **Citations**
The bibliography used in the development of the report is listed here, usually in order of appearance. Books, journal articles, proceedings, company reports, etc. are included. In general, only peer-reviewed documents are considered in this section.

10. **Appendix**
Extensive data tables, detailed product information, formula development, etc are included here.

III. **RECOMMENDATIONS**

Below are specific recommendations on preparing technical reports. There many references that can be used for writing a report. The most common ones are the Chicago Manual of Style, the American Psychological Association (APA), and the Modern Language Association (MLA).

1. **Style**
Reports are usually impersonal and therefore, they are written using third person. Depending on the situation, reports are written in past and present tenses. If the report activities have concluded, then past tense is preferred. In the case of ongoing experiments, present tense is used. Description of physical laws and proofs may also be done using present tense as they present information that is universally true.

2. **Table of Contents**
Depending on the length of the document, the student may or may not include a table of contents. The table of contents facilitates the readers to locate a certain part of the report. All pages must be numbered to facilitate this. Reports longer than 15 pages may require including a table of contents. For example, theses must include this section.

3. **List of Tables, Figures and/or Equations**
The same criteria as the previous item applies: include them if there are many of them to facilitate location and identification.
4. **Headings**

In general, the writer decides what format is going to be used to prepare the report. However, specialized journals require a predefined heading format. Once the format chosen, it must remain the same through the whole document.

Numbered headings are always recommended but other formats are accepted as long as it works well for the report. As an example, the following table is the one provided by APA: (http://flash1r.apa.org/apastyle/basics/index.htm)

<table>
<thead>
<tr>
<th>Level of heading</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Centered, Boldface, Uppercase and Lowercase Heading</strong>(^a)</td>
</tr>
<tr>
<td>2</td>
<td><strong>Flush Left, Boldface, Uppercase and Lowercase Heading</strong></td>
</tr>
<tr>
<td>3</td>
<td><strong>Indented, boldface, lowercase paragraph heading ending with a period.</strong>(^b)</td>
</tr>
<tr>
<td>4</td>
<td><strong>Indented, boldface, italicized, lowercase paragraph heading ending with a period.</strong></td>
</tr>
<tr>
<td>5</td>
<td><strong>Indented, italicized, lowercase paragraph heading ending with a period.</strong></td>
</tr>
</tbody>
</table>

\(^a\) This type of capitalization is also referred to as title case. \(^b\) In a lowercase paragraph heading, the first letter of the first word is uppercase and the remaining words are lowercase.

5. **Numbers and Units**

Numbers should be shown including their corresponding units. If SI units are used, then proper notation must be used. Remember that upper case is used when the unit is derived from the proper name of a person.

Example: 10 kPa rather than 10 Kpa

Label the numbers using proper scientific notations or prefix symbols

Example: 1.23 MN rather than 1234567 N

Use proper round up and reasonable number of significant digits when presenting data. Usually, 3 significant digits are used.

Example: 123 miles rather than 123.4567 miles.

6. **Equations**

Equations should be numbered according to their appearance in the text. Use parenthesis or square brackets to indicate the equation number. The text right after the equation should describe all the variables in it.

Example: \[ F = ma \] \( \text{[1] or (1)} \)

where \( F \) is the force in N, \( m \) is the mass in kg and \( a \) is the acceleration in \( \text{m/s}^2 \).
7. Tables

Tables should be labeled with an increasing number as they appear in the text. The title should be placed at the top of the table. Headers should identify the numerical data and their units.

Example: The deformation and the force of a spring are recorded every second with errors of 1 mm and 1 mN respectively:

Unacceptable

Table of Results

<table>
<thead>
<tr>
<th>Time</th>
<th>Deformation (M)</th>
<th>Force (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0s</td>
<td>0.0121</td>
<td>0.01023</td>
</tr>
<tr>
<td>1s</td>
<td>0.045</td>
<td>0.1116</td>
</tr>
<tr>
<td>2s</td>
<td>0.1008</td>
<td>0.19012</td>
</tr>
<tr>
<td>3s</td>
<td>0.15213</td>
<td>0.29489</td>
</tr>
<tr>
<td>4s</td>
<td>0.198</td>
<td>0.4009</td>
</tr>
</tbody>
</table>

Acceptable

Table 2. Spring Deformation Test Results

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>Deformation (m)</th>
<th>Force (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.010</td>
<td>0.010</td>
</tr>
<tr>
<td>1</td>
<td>0.045</td>
<td>0.112</td>
</tr>
<tr>
<td>2</td>
<td>0.101</td>
<td>0.190</td>
</tr>
<tr>
<td>3</td>
<td>0.152</td>
<td>0.295</td>
</tr>
<tr>
<td>4</td>
<td>0.198</td>
<td>0.401</td>
</tr>
</tbody>
</table>

Recommended

Table 2. Spring Deformation Test Results

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>Deformation (mm)</th>
<th>Force (mN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>45</td>
<td>112</td>
</tr>
<tr>
<td>2</td>
<td>101</td>
<td>190</td>
</tr>
<tr>
<td>3</td>
<td>152</td>
<td>295</td>
</tr>
<tr>
<td>4</td>
<td>198</td>
<td>401</td>
</tr>
</tbody>
</table>

8. Figures: Picture and Graphs

Figures should be labeled with an increasing number as they appear in the text. Figures include pictures and graphs. The title should be placed below the actual figure. In case of graphs, the axes should be clearly labeled which includes the variable and its units. Usually, the independent variable is shown on the horizontal axis and the dependent variable on the vertical axis. The type of data collected will determine the type of axis required: linear or exponential. If needed, grids can be added to facilitate data identification. In case a graph is included in the results section, it is not recommended to include a table with the corresponding data, as it is repeated information. Tables with this extensive data may be included in the appendix section.

In case more than one set of data is presented, each set must be clearly identified. In many cases, the best fitted line needs to be shown to corroborate the theoretical models, as well as its equation and corresponding R value. Please be sure that all curves can be easily identified.
Example: The curves deformation vs. force for two springs are presented.

**Unacceptable**

![Graph showing unacceptable results with equations and correlation coefficients](image)

**Acceptable**

![Graph showing acceptable results with equations and correlation coefficients](image)

*Figure 8. Spring Compression Test Results*
9. **Common References**

**Books**


**Online References**

- University of Colorado at Boulder, Program for Writing and Rhetoric:  
  [http://www.colorado.edu/pwr/writingcenter.html](http://www.colorado.edu/pwr/writingcenter.html)
- The Engineering OWL:  
  [http://engineering.colorado.edu/HOMER/owl.htm](http://engineering.colorado.edu/HOMER/owl.htm)
- Purdue OWL:  
  [http://owl.english.purdue.edu/owl/](http://owl.english.purdue.edu/owl/)
- Chicago Manual of Style:  
  Citations:  
  Tables, Figures and Equations:  
- American Psychological Association:  