Writing Guide: Formal Report Writing Instructions

These instructions are intended to provide a guide for writing your Formal Reports. You should think of yourself as an employee writing a report for your Teaching Assistant (TA) who is essentially your boss. (S)he has provided you with these requirements for your Formal Report and your success depends on how well you satisfy these requirements. READ THE FOLLOWING CAREFULLY:

1. The purpose of these reports is to prepare you for technical report writing in the workplace. Your TA does NOT want an academic report. You should mentally place yourself in the situation that your TA is your manager and (s)he has given you a task to do. Here that task usually consists of either evaluating an analysis tool or a mathematical model (such as digital signal analysis or a Single Degree of Freedom Mass Spring Damper). Part of the task includes reporting your results (how did digital signal analysis perform in your tests) and making recommendations for usage of that tool. (Do you think that digital signal analysis will work for your company? What are its limitations and how do you avoid them?).

2. Refer to "Guidelines for Preparation of a Formal Technical Report" for information regarding the paper structure, content, and writing style. Remember that your TA may have specific requirements.

3. Use "Composition Guidelines and Check List" to assure that the requirements for each section of the report are satisfied. In the first submission of your report number the items from the check list to assure that the paper is complete and properly structured.

4. Be clear and concise. Your TA, like your future managers, does not want to waste time trying to decipher your work. (S)he will reward you depending on the quality of your presentation and content.

5. For further information, see "Citing References" and "Reserved Reading to be Found in the Engineering Library" (both are following). Craig Gunn and your TA should both be available for consultation.

6. Grade sheets have been provided (following) for your information.
Guidelines for Preparation of a Formal Technical Report

The discussion below presents each of the required sections in the formal technical report. These sections present experimental studies in a rational, logical manner. As you write your report remember:

a) The report uses paragraphs to communicate through a logic structure with a beginning, middle, and end.
b) Each paragraph in the report uses sentences to provide a logical structure with a beginning, middle, and end.
c) Each sentence consists of carefully chosen words to clearly and concisely communicate the facts required in the above structure.

Think about the logical structure of your report as you read the sections described below.

Title: The title should be as brief as possible, consistent with clarity. Seven to eight well-chosen words is a typical length.

Abstract (Summary): Although it is placed first it should not be written until all other parts of the report have been completed. It should state in simple declarative sentences what was attempted and accomplished, how it was accomplished only if special techniques were utilized, and what was achieved. That is, it should contain the main results and the main conclusions based on the results. The abstract should be written with the expectation that it will be printed separately from the report.

This is both the shortest and most difficult section to write; it is also the most important. In technical publications the abstract, and only the abstract, is what most people will read. Therefore, it must communicate all the relevant ideas and results in 1-2 paragraphs. (250-350 words)

Remember that in the abstract, details of the experiment (which are in the past) need a past-tense verb. The use of the past-tense verb will keep the reader from getting confused over when actions took place. We use this kind of an abstract to allow the reader to see what was accomplished along with what was actually desired when the experiment began. Engineers out in industry do not have time to read great volumes of reports. They rely on the abstracts to give them the insight into what the experiment was about.

Table of Contents: Here the reader finds each heading along with the page where it can be found in the report.

(The Table of Contents is not listed, nor is the Abstract. One is obvious (table); the other should not be listed because it cannot rely upon the report for backup, for figures, or for additional information. The Abstract must stand alone and present the required information without any need for the reader to go into the report for explanation.)

Nomenclature Listing: All symbols used in the report are listed and defined in this section. They should be listed alphabetically, Arabic then Greek and in upper case then lower case order
Guidelines for Preparation of a Formal Technical Report

(A a B b c.) Be aware that abbreviations should be left in the text and not in the Nomenclature i.e. Fast Fourier Transform (FFT).

**Introduction:** The introduction should state the motivation for the experiment and the background information that is relevant for the present study. Also indicate how this study is relevant to the theme system. Note that the essential task for the introduction is to orient the engineering staff to the substance of the experiment and the context in which it was executed. When referring to the present report, it is acceptable to use the present tense. Future tense will explain what could be projected into future circumstances. In the introduction make use of active voice. Use direct statements and stay away from the passive voice as much as you can in this (and all) technical writing. For example, use, "We boiled the water.", not "The water was boiled by us." The introduction should briefly introduce the material contained in the report by noting what is presented in each of the sections that follow the introduction.

**Lab Observations**

**Analysis:** The purpose of this section is to present the mathematical model that you use to predict the system behavior and method by which that method was derived. Each experiment can, and should be analytically supported when presented in this section. The analysis should proceed from the general (and well-known) basic relationships and evolve the specific formulas to be used in the interpretation of the data. Note that symbols must be clearly defined. It is usually appropriate to make use of a defining sketch. All of the symbols used should appear in the "Nomenclature" described above. Analytical results, which have been previously derived and which are readily available (for example equations from a text), can be quoted with suitable reference. Their derivation need not be repeated if that derivation is not important to the reader's understanding of the experiment.

Typically, the analysis provided in laboratory handouts should be summarized and not copied verbatim in this section.

All relevant mathematical analysis should be presented. What is crucial to a good analysis are the supporting explanations and commentary on the mathematics. Do not require the reader to consult lab handouts or textbooks to understand the specific analysis required for the experiment. If it is important enough to mention, it is important enough to include.

**Experimental Equipment and Procedure:** A schematic representation of the experimental equipment simulation program, including detailed views of unusual or important components, is a valuable aid in informing the reader about the experiment. The sketch can be used to document pertinent dimensions of the apparatus and it can be used to specify the specific experimental equipment used for the study. If the procedure used in the experiments is not an established one, it is necessary to include details of the techniques used. The criterion here is that someone familiar with the general area of investigation should be able to exactly reproduce your experiments from the information given in this section. Be careful to describe the experimental procedure in the past tense. You may slip into the present tense when describing the procedure.
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needed to perform the experiment by a second party. In this section, the report's flow and overall feel can be destroyed by an incomplete or incorrect discussion of the experiment procedure and equipment. Some major points to remember are:

1 - When first referencing a figure, present the figure on the same page (or next page) as the explanation about it. It is distracting for the reader to have to look through the report to find a clarifying figure.

2 - Make figures at least one-third of a page in size. Figures that are too small are hard to read.

3 - Figures and tables should have clear and complete titles. If they are removed from the report, the information presented and its contents should still be clear. A short explanation of the figure contents under the title is normally necessary. Use the standard style - **Figure #. Title (no period after the title unless you have additional commentary)**. An example is:

Figure 14. Forefront of the cab-over design. Design first used in 1950.

**Results:** This is the section where the answers obtained from the analysis or experiments are presented. This section should contain short declarative statements of the results in reference to your presentation of specific graphic or tabular data, which are also presented. The purpose of these statements is to tell the reader (without discussion) what the author's interpretation of the results is, based upon the answers or data that are also presented. Keep in mind that the same data or answer could be interpreted in more than one way, thus the importance of your stated results. When stating these results vary your sentence structure. Don't fall into colloquial, jargonish, or slang language but aim for smooth flowing paragraphs that show more than just a mass of subject-verb-object structures. This section is a logical presentation of what was observed in the experiment.

The student should distinguish between "Figures," which are schematic drawings, photographs, graphs, etc. and "Tables," which are tabular compilations of data or computational results. Each type of data presentation should be sequentially numbered with a title: e.g. "Figure 1. Schematic of the combustion chamber."

While you are to present your data without discussion, do not present them without explanation. A results section with only tables and graphs in it is hard to understand. Remember, you want to make it as easy as possible for the reader to understand your message. Tables and graphs should be clearly labeled and titled with the 'stand-alone' ability of the figures.

**Discussion:** This section may start with a very brief summary statement of the results and then proceed to a discussion of these results. The principal task is to interpret the results, to note what is "as expected", what is unexpected, and what is of technical interest. The interpretation of the results in terms of the motivation for the experiment and its correlation to the current project should be the focus of the discussion. The discussion could involve a comparison with other
similar investigations or comparison with expected results. The strong points of the work should be brought out here along with any limitations, because if the writer does not point out the limitations of his work, someone else surely will later. It may also be legitimate to comment on possible future investigations. Discuss the experimental specific results, using references to the accuracy of the measurements. It is useful to note the estimated uncertainties and their effect on the calculated values. For example: "The pressure was 0.0 $\pm$ in H$_2$O and the velocity was 30 $\pm$ 10 fps. Note that the "information content" of this example is much larger than the statement: "the manometer liquid was fluctuating and the pressure could not be accurately measured." It is extremely important to provide specific discussions and avoid vague modifiers such as: greater than, about, like, and sort of.

Keep in mind that good paragraph construction will present a thesis statement or idea and then give supporting details for that thesis. When new points need to be made make sure you move to new paragraphs. You should design the discussion to follow a logical progression that will support the conclusions of the next section. Judge the information that you are providing to the readers. Readers have specific expectations. They expect to be presented information in a pattern that presents what is known first and then what is new second. Sentences start with old or known information and then expand upon this information with new related information.

**Conclusions:** "The following conclusions are supported by the results of this study:" is a useful way to begin this section. You can then list these conclusions in one or more simple (declarative) sentences using numbers to differentiate each separate conclusion. See the summary page in the “Signal Processing” section for an example. Remember that engineers are looking for concise statements that clearly tell them what your results and discussion have formulated. They are not interested at that point about further investigation or explanation. They want the masses of data synthesized into the briefest conclusions that you can make.

**References:** The list of references used should be included with great care taken to follow the specified format of the organization for whom the report is being written. The suggested format for this lab is shown below.

References are to be grouped at the end of the manuscripts and are to be given as follows:


Guidelines for Preparation of a Formal Technical Report


Always give inclusive page numbers for references to journal articles and a page or chapter number for books. Each reference must be cited in the text. (Taken from the AIAA Journal Instructions to Authors.)

Appendices: Simple or lengthy calculations, or side issues that are not really in the main theme of the report, should be relegated to the appendix. A criterion for the deciding whether or not to put something in the appendix is to ask the question "Is its inclusion in the main body of the report required for the logical description of the investigation?" If the answer is "No", the item should either be left out or put in the appendix.
Composition Guidelines and Check List

(Format of the Title Page – Please follow directions)

Title of the Report
ME 451
Fall 2014

(circle one of the following)
First Draft
Final Copy

Your Name
Your email
Lab Section
Lab meeting time and day
Lab TA’s Name
Date
Composition Guidelines and Check List

!!BE SURE THAT ALL OF THESE CRITERIA ARE FOLLOWED IN YOUR REPORT!!!

The following items make up the elements that will be evaluated in the formal reports for composition. Refer to Guidelines for Preparation of a Formal Technical Report for writing style guidelines and additional information. Teaching assistants will comment on the inadequate elements, and you will have to address those comments.

Examples of all these items can be found in the lab and in the library under Craig Gunn's name in the reserved reading.

ONLY SUBMIT CLEAR AND CONCISE REPORT TO YOUR TEACHING ASSISTANT!

The requirements are as follows:

**Title Page**
1. Title of paper
2. Course
3. Date due
4. Section time
5. Name

**Abstract**
6. Why was the lab performed
7. How was the lab performed
8. What was discovered, achieved, or concluded
9. Past tense used
10. Reference to experiment not paper
11. No personal reference (I,We)

**Nomenclature**
12. In alphabetical order
13. Upper case then lower case (A a B b c G g l a)
14. Arabic and Greek separated
15. Only symbols appear

**TABLE OF CONTENTS**
16. All sections represented
17. Abstract and Table of Contents not listed
18. Lab Observations as a heading Analysis, Equipment, Procedure - sub headings
19. All columns lined up

**INTRODUCTION**
20. Ample motivation for the experiment stated, with reference to theme system
21. Sufficient information to orient reader to the substance of experiment
22. Sufficient information to excite reader
23. Sections to follow mentioned

**GENERAL Lab Observations and Results guidelines (specifics follow)**

**Equations:**
24. Equations are numbered
25. Punctuation with equations (: with follow/s/ing only)
26. Equations have space
Composition Guidelines and Check List

Figures/Tables:
27. Figure/Table labels correct. (Figure 1. Title)
28. Figures oriented correctly, clearly labeled and referenced

Lab Observations
Analysis
29. Mathematical model used to predict system behavior presented with ample explanation and lead in.

Experimental Equipment and Procedure
30. Schematic of equipment used
31. Highlights of equipment used
32. Highlights of the procedure (not specific steps)

Results
33. Data presented with clear indication of what data applies to
34. Reader will understand what this data refers to
35. Trends in data stated (then to be discussed in the discussion section)
36. Clear indication of what reader should see in the data

Discussion
37. Complete discussion of the results appears
38. Connection of data and motivational theme system is clearly stated
39. Comparison to similar experiments is shown
40. Strong points of study given
41. Weak points of study given
42. Statements are specific
43. Logical progression to support conclusions that follow

Conclusions
44. "The following conclusions are supported by this study:"
45. Conclusions are numbered
46. Conclusions are concise and highly specific
47. Vague statements do not exist
48. Conclusions directly flow from discussion

References
(Reference Guidelines, which is included in the lab pack, has further guidelines)
49. Initials for first names
50. All information included
51. References numbered in text (i.e.: [1])
# Technical Grading Guidelines

**Abstract**

20

The main technical objective of the report is clearly stated
The method of an analysis or experimentation is briefly mentioned
The most important observation or finding is summarized
Statement are technically accurate
The specific conclusions drawn in the experiment are stated
The sentences contain appropriate information

**Introduction**

10

Reader is provided with the motivation for performing the experiment
Relevance of the experiment to the motivational theme system is included
Sufficient information to orient reader to the substance of the experiment is provided

**Concepts, Theory, and Method of Analysis**

20

Definitions and terminology are explained in detail
Governing equations are derived at an engineering level
Physical meaning of analytical solutions is explained
Equipment and experimental setup is explained in detail
Computer hardware and software are briefly defined
Alternate techniques or possible improvements are mentioned
Simulation or experimentation procedure is defined thoroughly

**Results**

20

Presentation of results are of engineering quality
Unnecessary information has been removed
The reader is guided on every important detail of a graph or table
The results are matched with equations and physical explanations
All topics in the lab handout are covered

**Discussion**

20

The performance of the analysis scheme and equipment is discussed
The methods, approach, or equipment are criticized
Alternatives and advantages are stated
Are the results conclusive?
Implications of findings are given
Discussion of how the results help achieve the stated objective is given
Other applications or examples where the results may apply are given
Suggestions on future work or further analysis are presented
Connection between physical and computer simulation is shown
Errors and short comings are pointed out, and reasons are given
Motivational topic is discussed in detail

**Conclusions**

10

Conclusions are stated in a specific context, not in general
Sufficient number of conclusions are stated
The most important conclusions are emphasized
Conclusions are technically accurate

TOTAL: 1000
Citing References

Listing Printed Sources: Books

Notice that the information about each source is divided into three sections, each followed by a period: author or agency's name (if there is one). title, and publishing information. Give the author's name, last name first, and the title in full as they appear on the title page. If the publisher lists more than one city, include just the first. Use just the first name of a publisher with multiple names: not Hold, Rinehart and Winston, but simply Hold. Omit initials too. For J.B. Lippincott Co., simply write Lippincott.

SINGLE AUTHOR

TWO OR MORE AUTHORS

MULTIPLE WORKS BY THE SAME AUTHOR

CORPORATE AUTHOR

GOVERNMENT DOCUMENT

TWO OR MORE GOVERNMENT DOCUMENTS BY THE SAME GOVERNMENT AGENCY.

Listing Printed Sources: Periodicals

JOURNAL ARTICLE WITH SEPARATE PAGINATION

To list an article from a journal that paginates each issue of a volume separately, provide the volume number and issue number, separated by a period. If no volume number is available, put the month or season in parentheses before the year.


JOURNAL ARTICLE WITH CONTINUOUS PAGINATION

In journals with continuous pagination, page numbers run continuously through all issues of a volume. To cite these journals, give the volume number, year, and page numbers.


SIGNED MAGAZINE ARTICLE


If the article's page numbers are not numbered consecutively, list the starting page number followed by +.


UNSIGNED MAGAZINE ARTICLE


SIGNED NEWSPAPER ARTICLE


UNSIGNED NEWSPAPER ARTICLE

Reserved Reading to be Found in the Engineering Library

Effective Technical Communication --Eisenberg--T 10.5.E36

General overall coverage of the major topics of technical writing. Includes proposals, letters, and reports.

Writing for Science, Industry, and Technology--Hirschhorn--T 11.H56

Especially good Appendix where information may be gathered by writers. An approach to writing that takes the writer from the beginning of the process to the end product.

English for Science and Technology--Huckin/Olsen--T 11.H23

Good book for the nonnative speaker in the process of report construction.

Designing Technical Reports--Mathes/Stevenson--T 11 f.M36

A process approach to the writing of a technical presentation from the information side not from the form of the report procedure.

How to Write and Publish Engineering Papers and Reports--Michaelson--T 11.M418

Primarily aims at the writing of papers for publication, but does a good job of looking at quality of writing and the concern for the reader.

Technical Writing--Principles and Practices--Miles--T 11.M47

A general text to help with basic problems and a great deal on the process of getting started.

Technical Writing--Turner--T 11.T786

A teaching text with a good visual format--nice section on memo writing.

Technical Writing--Fear--T 10.5 F4

For the writer who wants instruction in clear concise steps.

Reporting Technical Information--Houp/Pearsall--T 11.59

The best of the group for future use and present needs. Gives lots of examples and helps in the writing process.