Guide to ME 498 Reports

I. Formal Reports

A. Laboratory Writing Guidelines

(1) Title Page

The first page of the report should be a title page giving: (i) a descriptive title of the experiment, (ii) the author’s name, (iii) the course number and laboratory date, (iv) the name of the laboratory instructor, (v) name of the editor of the first draft, and (vi) the date of report submission.

(2) Abstract (Length ≈ two paragraphs, Weight ≈ 10-15%)

An abstract, clearly identified with an appropriate heading should be the first section of the report. Although styles vary, the abstract should include the main objectives of the experiment, the range of significant data, provide a brief summary of the results, and any major implication. The abstract should be self-contained and condense the report into a single paragraph. *This means you should not reference other portions of your report, especially data tables or graphs.* The abstract is an extremely important section since it should enable the reader to obtain the essence of the report in a compact form. *Students are encouraged to examine recent journal articles.*

(3) Introduction (Length ≈ 3-5 pages, Weight ≈ 15-25%)

The introduction discusses the importance of the subject. It provides the background for the study, and clearly states the objectives. Such objectives may include testing a theory, determining the numerical value of some parameter, or better understanding a certain phenomenon. The reader should obtain a clear picture of the motivation underlying the experiment and a concise statement of what was to be accomplished. Students should avoid copying the objectives directly from the lab manual; rather they should be stated in your own words.

In addition, this section should briefly discuss the underlying experimental theory. The assumptions used in developing the theory should be identified and the validity of these assumptions assessed. All assumptions should be viewed with skepticism in order to lay the groundwork to explain discrepancies between theory and experiment. *The governing equation(s) derived from the stated assumptions and application of the basic conservation laws should be given.* Each variable and parameter must be defined unless previously defined in the discussion of assumptions. If appropriate, nondimensional variables should be introduced and their significance outlined. The solution of the governing equation(s) should be presented, if available.

(4) Experimental Apparatus and Procedure (Length ≈ 1-2 pages, Weight ≈ 12-18%)

This section contains an overview of the experimental facility and procedure. Schematic diagrams are used to illustrate the important features of the apparatus such as key dimensions, placement of transducers, etc. The experimental procedure should be outlined, giving only enough information for another person to repeat the experiment. *Step-by-step procedures, especially those copied or
**paraphrased from the laboratory writeups, should not be given.** Rather, a discussion should be presented only for those steps that are particularly difficult, which require a special technique, or which are relevant to understanding specific advantages or disadvantages of the approach. Any experimental error that could influence the results should be quantified in this section and that includes listing ALL measurement errors from instrumentation.

(5) **Experimental Results and Discussion** (Length ≈ 3-8 pages, Weight ≈ 30-40%)

This section should summarize the results of the experiment in figures and tables of reduced data, along with an appropriate discussion that blends naturally with the preceding sections. Figures and tables should be accurate, concise, and complete. To this end, each figure and table should conform to the accepted practices of data presentation. Axes should be clearly labeled to indicate the axis parameter, its numerical scale, and the appropriate units. **Data points should be clearly designated by easily recognizable symbols such as circles, squares, triangles, etc. Theoretical results (including regression analysis) should be presented as lines.** Labels should be employed to delineate between the symbols and lines. All regression fits and correlation coefficients must be included in the body of the graph for inspection.

A discussion should accompany each of the figures and tables to reveal the purpose of each figure, as well as unify and supplement the information contained in the figures and tables. The discussion should also describe the statistical techniques used to reduce the data to final graphical form and assess the accuracy and reliability of the data. Experimental data should be interpreted in the context of underlying theory. Discrepancies should be fully discussed in the context of uncertainty in the experimental results and validity of theory.

(6) **Conclusions and Recommendations** (Length ≈ one page, Weight ≈ 15-25%)

This section should contain a clear and concise statement of the significant findings of the work, generally in order of importance. The conclusions are taken from the major points of the discussion. Your conclusions should tell the reader what you feel they should "get" from your work after they have read it. Recommendations include specific actions for improving the experimental procedure or for future work that builds on the results of the study. Recommendations should be specific and technically **justified** by the results and discussion of the experiment. This section should be thought provoking. Weak assumptions or experimental inaccuracies should be identified and the relationship to the model/data discrepancies delineated. Sources of error should be logical and technically substantiated; avoid attributing all discrepancies to vague concepts such as “human error” or “equipment inaccuracies.” The plausibility of the explanations should be demonstrated to a potentially skeptical reader by convincing arguments. Conjectures should be clearly identified!

**B. Requirements**

(1) **Typography**

All technical reports are to be typed, with **1-1/2 space (18 point) line spacing** using a character font no smaller than **12 point**, on 8 ½ x 11 inch paper. The Times font is widely used in the technical literature and is a good choice here. Each page should have a margin of at least **0.5 inch** of all sides. **Home computers may certainly be used for preparation of reports.** However, the quality of reports
prepared in this manner must be equivalent to those prepared in the Stocker Labs; inadequate software is not a valid reason for submission of low quality reports. Reports should be printed using a laser or laser-quality printer. The reports should be stapled in the upper left corner.

(2) Length of Text

The text of a formal report is limited to fifteen pages not including graphs and appendices. Penalties will be imposed for over-length reports or for ones using a font smaller than 12 point, line spacing less than 18 point, or margins less than 0.5 inch. The relative length of each section in a report can vary. No “filler” material, such as class handouts, should be included.

(3) Headings

Headings should be utilized to break the text into logical units.

(4) Grammar and Style

Reports must not only be technically correct but also correctly written. Clear, concise organization, and generally, careful attention to detail are essential to a good report. Spelling and grammar checking software can aid in locating errors, but are not a complete substitute for carefully organized and composed text. Students will proofread other’s reports and should endeavor to edit their own work before submitting it.

(5) Figures and Tables

All figures and tables must be referred to in the text and numbered sequentially within each type using Arabic numerals (1,2,3, etc.). Each figure and table must have a number and a caption that should be placed under the figure or over the table. In addition, figures and tables should appear in the same sequence as they are referenced in the text. Style variations are permitted among reports, but all figures and tables must fall within the range of accepted engineering practice. Students are strongly encouraged to examine recent journals and books. Although a wide variety of methods will be seen in different journals, notice that each figure and table is carefully prepared to convey information in a compact and readily understood form. For your formal report, the tables and figures may be appended to the text with all of the tables first followed by all of the figures.

(6) Equations

Equations should be typed using standard symbols and subscripts/superscripts for clarity. Equations should be numbered sequentially with the number placed at the right margin (i.e., right-justified).

\[ Q = A_{throat} \frac{Cd}{\sqrt{1 - B^4}} \sqrt{\frac{2}{\rho_{water}} \Delta P_{venturi}} \]  

(1)

(7) References

Since the text of ME 498 reports is required to be brief, large numbers of references are not expected. However, a separate reference section is needed even for one reference. Remember, it does not have to start on a new page, but should be separated by a header.
An example of text citing a reference is as follow: “This curve was developed using a Moody chart (Fox and McDonald)” or “This curve was developed using a Moody chart. [1]”

The reference in the Reference section should look something like this


(8) Appendices

Since the technical reports prepared for ME 498 are purposely meant to be brief, the inclusion of appendices is only needed for supporting calculation, derivations, or for specific requirements of the individual laboratory.

(9) Page Numbering

Pages should be numbered sequentially beginning with page 2. Page 1, which should not be numbered, is the page on which the abstract begins, i.e. not the title page. The pages at the end of reports containing tables and figures should also be numbered. The preferred location for page numbers is at the bottom of each page in the center.

II. Oral Presentations

For the purposes of ME 498, the oral presentation is a formal talk of approximately 15-minute duration followed by a question-and-answer period of several minutes. The technical content of the oral presentation is similar to that of a formal report, but the method of communication is different. In the oral presentation, viewgraphs lead the speaker and the audience through the subject matter in an orderly manner. A variety of different kinds of viewgraphs may be used. Some material (the statement of objectives, for example) is best presented using viewgraphs that contain a series of simple, direct statements in outline form. Other material (experimental data or experimental apparatus, for example) is best presented using charts, graphs, and illustrations similar to the figures appearing in technical reports. Still other material (the underlying theory of the experiment, for example) is best communicated using a flow chart of a series of slides which illustrate the logic of the theory development. The oral presentation fosters interaction between the audience and the speaker, thus allowing for clarification of key points.

A. Organization and Contents

An oral presentation is organized in a manner similar to technical reports as described here
(1) Title Slide

The title slide should contain a brief title for the presentation, the name of the presenter, the course number and lab section, and the date of the presentation. The title slide provides a means of introducing your subject and yourself to the audience. You should use the title slide to launch your talk in an effective and positive manner.

(2) Overview

This slide should preview the following parts of the speech. It is best not to read this slide. Instead, tell why you are doing this presentation. What made this report significant to you? Remember, you have about 30 seconds to get and keep the audience’s attention. Reading your overview will quickly lose their attention. Instead, point out that your slide gives your overview and then transition to the importance/significance of your work (or an aspect of the topic of your work.)

(3) Objectives

The next slide should provide a clear, concise statement of the purpose of the work. Typically, between two and six major objectives are enumerated. The individual objectives may be numbered or may be identified using bullets. The objectives should be stated using a few key words with little or no elaboration. In the accompanying oral remarks, you can elaborate on and explain your points so that the audience fully understands the purpose of your work.

(4) Methodology/Background

Having clearly stated the motivation for your work, you should next explain how the objectives were accomplished. This slide of series of slides should state the major features, methods, assumptions, and equations of the experiment and/or analysis, again, using a few key words. You should also present any key terminology, parameters, or concepts that are central to your analysis and interpretation of results. For example, if you will be later discussing lift/drag coefficient results, this section should discuss similitude, reasons for non-dimensionalization of results, concepts of lift and drag, angle of attack, etc.

(5) Experimental Setup

Using this slide or slides, you help the audience visualize the experiment and the key physical processes that influence system behavior. You should point out the aspects of the experiment here that are better described by schematics than by words. Your accompanying oral remarks should complement the material on the slide and direct the audience’s attention to the key elements contained therein. For example, you should note certain key dimensions to give the audience an impression of the size of the apparatus you are using. This approach is generally preferable to extensive labeling of dimensions as would be done in an architectural or shop drawing. Also, you
can call the audience’s attention to the instrumentation being used. You can also point out key physical effects and/or lay the groundwork for helping the audience understand any deficiencies in the experimental approach or quantify experiment errors that come to light later in the presentation.

(6) Discussion of Results

The results slides should explain the major findings in graphical form. For each slide, oral remarks should help the audience interpret the results. The combination of written and oral elements should produce logically linked thoughts that lead to a set of well-defined conclusions. Also, please use a bulleted slide to transition to the results from the Experimental Section. Moving directly to results can be very confusing.

(7) Conclusions and Recommendations

The last slide or set of slides should present the major findings that follow logically from and be supported by the discussion of the results. The conclusions should 1) summarize the major findings from your work as compared to previous work of others and 2) be tied to your central theme (or objectives) as closely as possible. Recommendations should describe how to improve the experiment in any related and practically attainable (note, cost limits practicality!) This slide should also state the major points using only enough words to effectively convey the idea. Your accompanying oral discussion should then sufficiently explain these points.

B. Requirements

(1) Length of Presentation

The presentation consists of an approximately 15 minute formal talk followed by a short question-and-answer period during which the student is tested on understanding of the various aspects of the experiment. Time limits for the presentation will be strictly enforced. As a rough rule-of-thumb, the average time per slide is approximately one minute for most speakers. In the organizational outline discussed above, all sections except the “Discussion of Results” should be limited to one or, at most two slides. Major emphasis should be places on the results rather than on the introductory material.

(2) Viewgraphs

The student should prepare a set if viewgraphs, suitable for use with an overhead projector or developed for a projected Powerpoint presentation, to aid in the effectiveness of the oral presentation. The viewgraphs should be carefully developed and prepared to be legible when projected. The student should also bring a paper copy of the viewgraphs to the presentation in addition to the set of overhead transparencies. Further, all raw data, uncertainty calculations and statistical analysis should be turned in on separate sheets of paper.

Each viewgraph should have a concisely worded title so that the audience can quickly determine the contents of the slide before reading it in detail. As a rule, slides that contain text only should have at most about six bullets that are succinctly worded. It is also absolutely essential that the graphics used be complete and legible, yet contain no superfluous information which may confuse or distract the audience. All plots should follow the rules of good practice for engineering graphics including
the clear labeling of axes, the clear definition of the units and scales being employed, and a clear legend for the curves and points shown. In general, only one figure or plat should be included for a viewgraph. It is also customary to omit figure numbers and captions in an oral presentation.

An added consideration when preparing graphics for an oral presentation is the ability of the audience to read the slide from anywhere in the room. For maximum readability, the amount of information contained on any one slide should be limited, and a large portion of the image area of the slide should be used. Also, the lettering on the slide should be large enough to be easily read at a glance by any member of the audience when projected on the screen. A rule-of-thumb for transparencies is that the lettering should range in size from about ¼ in. (18 point) for minor items to as much as ½ in. (36 point) for the title. Use of a “simple” font such as Helvetica is strongly recommended. In addition, the same font and consistent use of font sizes should be utilized throughout the presentation.

(3) Presentation Style

Your discussion should flow naturally from one point to the next, and everything should be related to your problem statement or central theme. Avoid wasting precious presentation time with mere repetition of what is already obvious from the slide. Also avoid “reading” the slide; assume the audience will do this. If your talk moves along at a steady pace, the attention of the audience will be maintained and they will be inclined to follow along with you. Periodically, let the audience know where you are headed. For example, you can introduce a sequence of several slides with words such as “the next three slides illustrate the results of our study.” Break a long series of slides containing plots or equations into more readily digestible chunks. Audiences tend to become bored quickly with long uninterrupted strings of similar slides. Avoid including slides that add no new information simply because you made them and don’t want to exclude them. The inclusion of weak ideas or pointless information has the same degrading effect on an oral presentation as “filler” material has on a written report.

Many intangible elements contribute to the effectiveness of an oral presentation. Sloppy appearance or a rambling, disorganized discourse conveys an impression of sloppy work that may overshadow an otherwise technically competent presentation. On the other hand, it is important to promote a relaxed atmosphere and develop a comfortable rapport with the audience. Body language, such as movement and gestures, can be very effective in putting a point across. The listener’s attention is more easily maintained when he or she feels personally involved. In short, the presentation should be convincing and powerful without being overbearing. Students should practice their presentations, perhaps in front of a friend, to help organize their thoughts and to better judge the time required.