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Senior Design Report Handbook for Senior Project and Workshop

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everywhere* else
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12 point

Christopher Carroll
Imran Hayee
Scott Norr

Advisor: EE faculty member

Approved: _____ _____
advisor date

Electrical Engineering
University of Minnesota Duluth
Duluth, MN 55812

* exceptions are always possible in special cases!

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Major heading and body

Acknowledgements

This Senior Design Handbook is the result of years of experience in offering the Senior Design topic in the Electrical Engineering department, both through the Senior Project course sequence (EE 4899/4999) and Design Workshop (EE 4951).

Two spaces between
major sections

Text is
single spaced

Abstract

The information presented here by example shows a suggested format for the Senior Design written report. Details such as font, margins, and spacing are shown, as well as suggestions for major sections and report organization. Information contained here will aid in the preparation of the final written report for either the Design Workshop (EE 4951) or Senior Project (EE 4999) courses.

This section of one or two paragraphs should summarize the objectives of your project and how they were accomplished, in about 50 to 300 words. Please do not confuse this with an introduction, which sets the background for the project. The abstract is a very important part of the report because often people will decide on whether to read the rest of the report based on what they read in this section. Although it comes first in the report, it is often written last so the author can be sure of what is written in the report before summarizing it.

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Main body starts on new page, #1

I. Introduction

The Senior Design final written report is a required part of the Senior Design experience. Written reports are an essential part of any engineering project to record the activities and report the results of the work. The introduction should discuss similar designs, and what you did that is different or better. Whenever you discuss the prior art either from a book, a paper, or a technical report, it should be referenced properly [1].

Reference citation style

A. Overview

EE 4899/4999, Senior Project I and II, together comprise a two-semester course sequence that allows Electrical Engineering students to work as a team in developing and executing a group design experience. EE 4951, Senior Design Workshop, offers a similar alternative one-semester team design experience. Students, working closely with their team members and senior design advisors, and using all the skills and knowledge they have gained in course work, create and implement a design of their choice. A written summary and oral report are due at the end of the semester in which EE 4999 or EE 4951 is taken.

Sub-section headings in *italics*

B. Registration

Registration for EE 4899/4999 or EE 4951 requires some planning. For EE 4899/4999 you need to have a design team of at least two students prepared to work together, and you need to enlist an EE faculty member to serve as your Senior Project advisor. Your design team should include some interdisciplinary flavor, such as expertise or experience from outside the department. For any of these courses you need to obtain a permission number to register, as the courses are normally closed except by permission.

II. Background

Senior Design work is known as a capstone experience. It is meant to demonstrate that students can integrate knowledge and skills gained in their other coursework and apply that information to solve a design problem. The capstone experience is common to all engineering programs, and proves that information provided to students in the various programs is adequate to address significant design problems successfully.

III. Equipment

Equipment needed to complete a design project will vary from project to project. Some projects will be entirely software-based, others will be focused just on hardware, and in some there may be a mix of both. This section describes the equipment used to complete your design. Figures should be numbered using Arabic digits and should be referenced in the text.

Often, figures are useful in describing equipment employed in the project. Figure 1 is an example of how a figure is incorporated. The figure should be placed near but not before the spot in the text that references it. The caption on the figure should be brief but informative. Be sure that the figure fits within the 1-inch margins on the page. When embedding the figure within text as shown at right, try to avoid single lines of text above or below the figure. Number the figures consecutively as they appear in the text, and include the figure number in the caption of the figure. The figure caption should be in italics just below the figure itself.

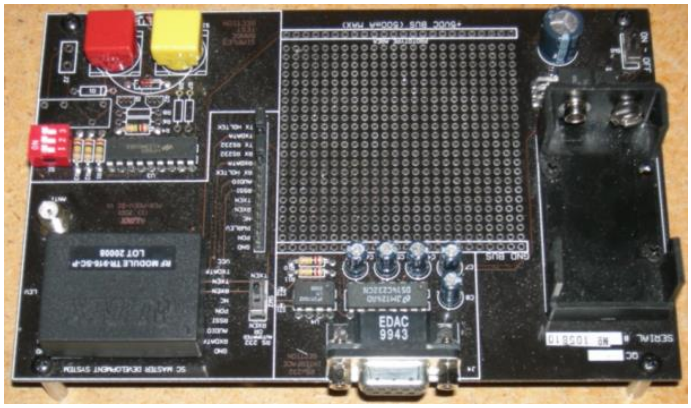

Figure 1. Board on which project is built

Your Equipment section should include a Bill of Materials used and a budget detailing the expenses involved in your project. What would it cost for someone to duplicate your project, or to mass produce it in a real world application?

IV. Procedures

In this section you record the processes you used to reach your design solution. This can include samples of calculations, software development, equipment specifications, etc. Figures are often useful to explain concepts that are hard to describe in words, such as Figure 2 at right. Make your figures large enough to be legible, while still staying within the one-inch margins of the page. The text must reference each figure by number, and the figures must not appear before the place in the text where they are referenced. Figures should be neat and legible. Computer-generated diagrams or graphs are better than hand drawn sketches.

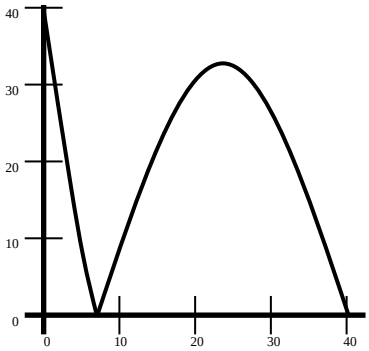

Figure 2. Output vs. input

V. Professional Component

You must address most of the following professional components of your senior design project in this section. This requires you to acknowledge that any engineering project, including your senior design project, impacts a wide spectrum of human experience, not just your design team or colleagues. The following is a list of important professional considerations which you might discuss in this section. Try to identify how you incorporated concerns in these areas into the design process while developing your design solution.

1. Economic Concerns
   - Does your design fit within economic constraints of your budget?
   - Is your design affordable for the target customer for your project?

2. Environmental Concerns
   - Does your design produce waste that threatens the environment?
   - Is your design compatible with existing environmental codes?

3. Sustainability Concerns
   - Does your design waste raw materials?
   - Does your design use renewable energy resources?

4. Manufacturability Concerns
   - Is your design mass producible or must it be hand-crafted individually?
   - Is your design a one-of-a-kind device, or can it be replicated easily?

5. Ethical Concerns
   - Does your design address the ethical issues delineated in the "IEEE Code of Ethics?"
   - Does your design impact the rights or liberties of others?

6. Health and Safety Concerns4
   - Does your design meet applicable ANSI and/or IEEE standards?
   - Do you provide adequate instruction for safe use of your design?

7. Social Concerns
   - Is your design compatible with existing social concerns or standards?
   - Does your design interfere with the lives of others?

8. Political Concerns
   - Does your design work within the laws of your community?
   - Does your design require any special licensing or permission for operation?

VI. Results

In this section you should discuss how well the design worked. Give results of any simulations and laboratory tests. Analysis of the design results is often included here.

If you include a table in any of the sections of your report, it should not exceed the width of the page. Furthermore, the table number and title of the table should be located directly above the table while the caption of the table should be located directly below the table. Refer to Table I below. Tables are numbered in capital Roman numerals.

Table I. Grades for EE 3210

Student #	Lab1	Lab2	Lab3	Lab4
1	4	3	5	5
2	5	5	5	5
3	2	0	3	3
4	5	4	4	5

Lab grades on a 0-5 point scale

VII. Discussion

In this section you should describe what kind of technical and nontechnical challenges and problems you faced during your design process. Documenting both successes and failures will help the reader of your report extend your work without going down any unproductive blind alleys.

VIII. Conclusions

In this section, you should summarize conclusions and results made in the rest of the report. No information not previously introduced should be included in this section. Answer questions about how well your design met its goals. Suggest possible design improvements laying down the foundation for future work.

References start
a new page

X. References

These are documents referred to in the text, listed in the order in which they are referenced, and numbered consecutively. They are not alphabetized.

1. Westinghouse Electric Corporation (Staff of Technology and Science, Aerospace Div.), Integrated Electronic Systems. Englewood Cliffs, NJ: Prentice-Hall, 1970
2. F. Author, S. Author, and T. Author, “Sample journal article,” *Important Journal*, vol. V, no. N, pp. yyy–zzz, 2004.
3. Author1 and Author4, “Sample conference article,” in *Proceedings of Good Conference*, Nice place, 2004, pp. 57–61.
4. G. Student, “Ticket to success,” Ph.D. dissertation, University of Minnesota, 2004.
5. F. Author, S. Author, and T. Author, “Worlds best technical report,” University of Minnesota Duluth, Department of Electrical Engineering, Tech. Rep., 2008.

Bibliography starts a new page

XI. Bibliography

Often the References section documents the external sources that you used for your report. However, if you wish to include a list of works and URLs you consulted but did not directly refer to in your report, or that you with to recommend to you readers for further reading, include a Bibliography page after the Reference page and following any appendices. The following rules apply:

- Order – Entries are alphabetized by author's or editor's last names, or by the first significant word for works without authors. Examples

  Penguins World Atlas, The. Harmondsworth, England: Penguin, 1984.

  Schilling, D. L., and C. Belove. *Electronic Circuits, Discrete and Integrated*. New York: McGraw-Hill, 1979.

- Spacing – Indent second and subsequent lines. Single space individual entries. Double space between entries.

- Do not number entries.

Appendices start
a new page

Appendix A

IEEE Code of Ethics

We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

1. to accept responsibility in making decisions consistent with the safety, health, and welfare of the public, and to disclose promptly factors that might endanger the public or the environment;
2. to avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;
3. to be honest and realistic in stating claims or estimates based on available data;
4. to reject bribery in all its forms;
5. to improve the understanding of technology; its appropriate application, and potential consequences;
6. to maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;
7. to seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;
8. to treat fairly all persons and to not engage in acts of discrimination based on race, religion, gender, disability, age, national origin, sexual orientation, gender identity, or gender expression;
9. to avoid injuring others, their property, reputation, or employment by false or malicious action;
10. to assist colleagues and co-workers in their professional development and to support them in following this code of ethics.