

Capstone Design (ENGN 379): Final Report Guidelines

The guidelines below set the expectation for both *content* and *formatting* of the final report.

ORAL REPORTS

(Fri April 24, 2020, 9 am –noon)

Each team will present an oral report, approximately 20 min in length, followed by 10-15 min for questions. The presentation should cover in succinct format the content items numbered 3 to 12 listed below for the written report (plus citing references at the end).

WRITTEN REPORT

(Due 5pm, Friday, April 24, 2020)

Each project group will submit a *single* written report by the due date listed. Each team is *required to submit a draft of the final report by Friday April 17, 5pm*. The instructor will review it and provide feedback on content, and that formatting guidelines are followed.

CONTENT: The report should include the following major sections. Sections may be combined where it makes sense. Each sections should include subsections, as appropriate. As a general guideline, the report is likely to be about ~40 pages in length (just a rough guideline, your mileage may vary). The report should be visually rich---include many carefully made, beautiful figures, where appropriate.

1. Title Page
2. Table of Contents
3. Project Overview/Executive Summary
4. Introduction/Background and Problem Statement
5. Stakeholders and Market/Economic Analysis
6. Design Objectives
7. Final Design: Details and Rationale
8. Testing and Evaluation Procedures
9. Results: Analysis and Interpretation
10. Discussion and Future Work
11. Conclusion
12. Acknowledgements
13. References/Works Cited
14. Appendices

FORMATTING

The final written document must have a *professional polish*. To this end, each of the following section must follow the following guidelines. Remember your audience: The main ideas should be conveyed such that a lay-reader can understand the general nature of the project. Meanwhile, the technically minded/fellow engineering should be provided with enough rigorous detail such that your design can be analyzed, interpreted, replicated, and potentially revised in the future.

Pagination: Each page of the report should be numbered consecutively, starting with the Executive Summary as page 1.

Line Spacing; Figure and Table Placement: Double-spaced main text throughout. Figures and Tables should be placed immediately below where they are first mentioned in the text, but not breaking paragraphs. Figures and Tables should be set apart on their own lines, such that there is no text to the left or right.

Section Numbering and Labeling: Each major section heading should be numbered with consecutive Roman numeral starting with the Introduction section. For instance “I. Introduction and Problem Statement” and “II. Stakeholders and Market Analysis”, etc. Each subsection heading should start with a lower case letter, e.g. in the Design Details section you might have “a. Shoe Capsule” and “b. Heel Lock Mechanism” and “c. Lace Tightening Mechanism”, etc.

Figures and Tables: Figures should be assigned consecutive numbers 1, 2, 3... (Figure numbers always increment; they do NOT reset with each new section). Each figure must contain a caption with informative text. Figure captions must be placed BELOW the main graphic. Use [MS Word caption feature](#) to insert captions with right click on graphic > Insert Caption... (this will save you massive headaches in figure numbering later). Ditto for Tables. (Do NOT mix Figure and Table numbers). For example, one caption might read “Figure 1. Topographic map of Belfast trail site. The parking lot contains 60 spaces in a 1 acre space”. Then refer to these figure numbers in the main text, e.g. “Figure 1 shows the overview of the parking lot layout.” Ditto for tables. Figures should be professional and polished and tell the story on their own. This takes a *lot* of time, and it is time well-invested...beautiful graphics make for a very readable report.

CONTENT

Title Page: Title of Project; Team member's full names; Date submitted (Month/Day/Year). You may also include a figure/graphic, as deemed appropriate (e.g. W&L logo/crest + other sponsor/partner's logos for their organization)

Table of Contents: List all sections and subsections, as appropriate, with respective page numbers. Appendices must also be included. MS Word has a [nice tool for auto-generating a table of contents](#).

Executive Summary: Set apart on its own page. Should be a single paragraph (~200 words max) summarizing the overall project.

Introduction and Problem Statement: What is the real-world problem you are trying to solve with your design? Why is this problem/issue important to solve? Note: you can basically copy and paste appropriate sections—with revisions as necessary—from your fall term (Engn 378) final report.

Stakeholders and Market Analysis: Identify whom is directly and/or potentially affected by the issue identified in the problem statement? This could be anything from the general populace (hands-free shoes, passive river trash removal); or a more specific constituency (e.g., users of Woods Creek Trail, hikers who park at Belfast parking lot; W&L campus garden workers and school groups). Market/Economic analysis should describe prior art and/or where your product fits into the market, as appropriate.

Design Objectives: Identify what your design *must do* (e.g. "must sustain dead and live loads of pedestrians crossing bridge up to ___ kips") to be successful. Identify you're your design sought to *optimize* (e.g. cost, aesthetics, simplicity/minimal components, etc.)

Final Design - Details and Rationale. A detailed exposition of *what* you designed and *why*. This section must also include specific details on how the device is actually fabricated and/or calculation/simulation techniques, as appropriate. Where it makes sense, you should also discuss design alternatives that were ultimately not selected. Note this is basically a copy and paste of winter term (Engn 379 Document II). A Bill of Materials must also be included somewhere in the report, probably either in this section or as Appendix if it makes more sense for overall flow/organization (see below "Bill of Materials" and "Appendices").

Testing and Evaluation Procedures: Describe in detail experimental, quantitative or other evaluative methods did you use to assess the performance of your design. This section may also explicate math models you used for comparison against experimental values (e.g. "A fatigue

analysis of the heel spring showed that _____.” Or “Theoretical drag force was computed as $\langle \text{formula} \rangle$.”) Essentially, this is a copy and paste job, as appropriate, from Engn 379 Document I.

Results—Analysis and Interpretation: Presentation of your results in beautifully illustrated format. The surrounding text should highlight the main observations and guide the reader to salient findings. The interpretation should help the reader understand the overall performance of the design(s). For example, “We computed a load on the middle support beams of the shelter to be ____ kips. Note this is well-below the maximal stress of ____ kips the Virginia pine can sustain in axial load” or “Swirl design A with a radius of ____ cm caught 50% of incident trash. By comparison, swirl design B caught 72% of trash, indicating that _____.”

Discussion and Future Work: Contextualize the benefits/merits of your current design.

Address known limitations. For future work, what would you suggest to improve the current design, and/or what the next steps in the life-cycle of this project? This could range in nature from “In order to increase the durability and lifetime of our the heel lock mechanism, we suggest using injection molded plastic instead of ABS 3-D printed plastic”; or “We have submitted our final design for the proposed Woods Creek Bridge to Truman Payne, Assistant University Planner. We are hopeful that the proposed design will inform that actual structure built in the future.”

Conclusion: Summarize what has been accomplished. Highlight novel/unique design elements developed and how they helped solve the engineering problem. For instance, you might have “We have developed a comprehensive plan for the Belfast Parking Lot that addresses: i) number of parking spaces; ii) traffic flow patterns in accord with VDOT regulations; iii) soil mechanics to bear the load of vehicles without degradation; and iv) drainage system that prevents excessive wear due to rainfall events. Our design also addresses the concern of neighbors that the land scar be minimized.”

Acknowledgements: Say thanks to anyone who helped you with the project. Could be IQ Center assistance from Mr. David Pfaff; Engineering faculty who helped you with technical elements, your local community and/or campus contacts, etc.

Bill of Materials: Use Excel table format. List all items integrated into the final design. Include vendor, part number, quantity, and cost per unit, etc.

Appendices: must be labeled consecutively with capital letters A, B, C,... and include an informative heading. For instance “Appendix A: Detailed Structural Load Calculations”

Works Cited: Use APA or IEEE formatting style for citations. Note that you can use google scholar to copy and paste citations in APA format. You may follow either of 2 standard conventions when referring to cited works in the main text. Throughout the work, cite references with as (First Author, Year); or [CITATION NUMBER]. Each citation should be labeled accordingly in the Works Cited Section. See examples below. It is strongly recommended that you use [MS Word Reference Manager Tool](#) for citation (else risk going batty keeping track of numbers yourself).

Convention 1: “Recently, it has been shown that a temporal Weiner filter can subtract motion artifacts from cutaneous gastrointestinal recordings (Gharibans, 2016).”

Convention 2: “Recently, it has been shown that a temporal Weiner filter can subtract motion artifacts from cutaneous gastrointestinal recordings [1].”

Then in the Works Cited, respectively, you would use:

Gharibans, A. A., Kim, S., Kunkel, D. C., & Coleman, T. P. (2017). High-resolution electrogastrogram: a novel, noninvasive method for determining gastric slow-wave direction and speed. *IEEE Transactions on Biomedical Engineering*, 64(4), 807-815.

-OR-

[1] Gharibans, A. A., Kim, S., Kunkel, D. C., & Coleman, T. P. (2017). High-resolution electrogastrogram: a novel, noninvasive method for determining gastric slow-wave direction and speed. *IEEE Transactions on Biomedical Engineering*, 64(4), 807-815.