ME4182/ME4723 – Second Progress Report & Presentation, Initial Fab Package

All team members are responsible for the content of the deliverables: 1) report, 2) initial fabrication package, and 3) team presentation.

Deliverable #1 – Report

The report clearly, concisely, and logically documents work to date including the process as well as the results. It is not a chronology and neither is its oral presentation counterpart. Well-developed sketches, drawings, charts and tables are essential elements of the report and presentation.

The second report builds upon the first report but is a complete stand-alone document (as if the first report doesn't exist, and is not accessible to the reader) that reports on all work done and progress made from the beginning of the semester to date. Although it should include material from the first progress report, you should not just copy those sections from the first report, but integrate the comments received from your instructors, sponsors, etc., and write the second report based on your new learning and progress.

The report should normally cover the items listed below but ordered for the most logical reading. **The outline is not a template nor does it constrain the report structure.** Leave out items the project does not encompass and add topics where needed. Write for the intended audience which is technically educated yet unfamiliar with the project and its specialized technology, language, or conventions so provide sufficient context to facilitate full comprehension.

Refer to the course schedule on the ME Capstone Design website for links to additional guidance for specific sections of the report.

REPORT FORMAT

The typical structure for the report is as follows:

a. Cover Page
b. Table of Contents (start on new page)
c. Executive Summary (start on new page, no more than two pages)
d. Nomenclature (start on new page)
e. Main Body (start on new page and start numbering sections numerically)
f. References (start on new page)
g. Appendices (start on new page and start labeling appendices alphabetically)

More details are given in the following sections. Pay attention to the "BASIC STANDARDS FOR WRITTEN TEXT" that begins on page 7 of this document.

Cover Page

Provide the team name; project title; class section, instructor; school name and address; client's name, address (including e-mail) and phone number (if applicable); Names of students with signatures optional; indicate name of primary editor

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Table of Contents

Include a table of contents with page numbers for each section and subsection.

Executive Summary

The Executive Summary is NOT an introduction. Rather, it's a stand-alone portion of the document that could be distributed apart from the rest of the document. The Executive summary reads as if the Introduction does not exist, and vice versa. Think of it as a document that the CEO of a company would read in place of the complete report. Basically, describe motivation, approach, and results. Specifically, include:

a. What is the design problem?
b. What are the technical problems?
c. What is the selected design solution?
d. What is the overall design/technical/objective(s)?
e. What tools/methods are used to guide the work?
f. What are the key performance specifications?
g. What is the proof of concept? What demonstrates that the solution works?
h. What are the next steps/future work?

Nomenclature & Glossary

a. Nomenclature: Provide an alphabetical list of symbols/variables/parameters used and their definition/meaning. Include units used for each symbol or variable, as well. If it appears in an equation anywhere in your document, it should appear here, too.
b. Glossary: Provide an alphabetical list of acronyms and their meaning.

1. Introduction and Background (start on new page and start numbering sections numerically from 1)
The introductory material explains the nature and scope of the design problem and provides necessary context for the remainder of the report. Use of imagery to convey the current art or problem is very valuable!

a. What is the design problem, motivation, and need? Provide a layman's (simple) description of the design problem/opportunity and provide contextual background information (as appropriate; consider your audience).
b. What is the intended use? Provide a discussion on the intended purpose(s) or use(s) of the product. Include description of product user(s) and operating environment for product.
c. Discuss desired product functions, special features, points of interaction with other products/devices (e.g., hardware/software integration), etc.
d. Value Statement - benefits to user(s) and other stakeholders, incl. patients if applicable.
e. Discuss technical issues, challenges and opportunities. Include any regulatory, code, and standards issues, if applicable.
f. Briefly state/summarize potential desired solution(s) if known, alternatives as appropriate, key performance aspects, and your intended means of demonstrating proof of concept.

g. Briefly introduce the content/structure of the remainder of the document.

2. Existing Products, Prior Art and Applicable Patents (portions may be an Appendix)

Provide information on current competitive products/procedures. Discuss their relevance to the problem and/or its potential solutions. Draw learning and opportunities from the identified sources.

a. Document and discuss any competitive designs already on the market, or in research and development. Consider:
    a. What are the commercial applications of the technology?
    b. How does underlying technology work?
b. Perform a patent search and identify related concepts.
c. Discuss how existing products, prior art, related art, and patents are relevant to or different from your intended design, with technical detail to support your discussion (power, weight, cost, etc.).

3. Codes and Standards

a. Identify whether there are any relevant engineering standards applicable for your project. Consider that many industries have their own standards bodies (e.g., ASHRAE), as do many professional societies (e.g., SAE, ASME). Library guides and standards are available at: https://libguides.library.gatech.edu/mechanical-nuclear-engineering
b. Discuss how you addressed applicable standards within your design.

4. Customer Requirements and Engineering Design Specifications

In this section, you will define the engineering design specifications for your design based on customer requirements, desired functions, and applicable constraints (see lecture material). Wherever possible, be as quantitative as possible in your specifications and provide measurable targets. For example, instead of "fast" use "speed greater than 10 miles/hour".

a. Discuss the stakeholders. Include stakeholder "2x2" chart as discussed in lecture.
b. Develop and discuss a list of customer requirements. Also think about human factors considerations and metrics for customer satisfaction.
c. Develop and discuss the functions that the design is supposed to perform and develop associated performance metrics (i.e., how well should it do "it"?).
d. Develop a list of constraints, for example, does this product have to function with specific other products that impose constraints (like software/hardware), does solution have to utilize specific materials or manufacturing processes, etc. Also, consider constraints that may be imposed by standards.
e. Define and discuss the set of detailed engineering design specifications based on the preceding. Consult lecture material for a specification checklist (e.g., include quality requirements (define allowable tolerance levels), mechanical properties, material requirements, etc. Be as quantitative as possible when defining amounts, ranges, limits, tolerances, units, etc. Use a

properly structured specification sheet and supporting prose; include reference to how each specification has been/will be validated.

f. Identify and describe the relative importance of the specifications. Employ appropriate tools such as a House of Quality, etc., with supporting descriptions.

5. Market Research/Potential Impact

a. Describe market research plans such as customer surveys, focus groups, gathering market information from studies, internet, experts, etc. (For BME: include number of potential procedures/uses per year (with references)).
b. Describe the results of market research including market size, demographics, target price, go-to-market strategy, number of potential procedures/uses per year (with references, information on current competitive products/procedures, target market sales price; with a brief justification comparing to predicate device(s) or methodologies.
c. Discuss impacts, if any, of your market research on the design.
d. Discuss/provide any client reviews and user evaluation, if applicable.
e. Try to quantify, where possible, the potential economic impact of your project for the client, sponsor, or customer for your design project. For instance, if the project reduces energy consumption, calculate the estimated energy savings in kilowatt-hours (kWh) or percentage reduction in energy consumption. If it improves a process, estimate time or cost savings in terms of reduced labor hours, materials, or maintenance expenses.

6. Design Concept Ideation

In this section, the concept ideas you generated are to be discussed. Feel free to use an appendix to include additional concepts and details.

a. Discuss and list the functions that the design needs to fulfill
b. Identify and describe different concepts for fulfilling each function. Use ideation techniques covered in lecture.
c. Present and discuss a morphological (matrix) chart with these different concepts/possible solutions for each (sub)function.
d. Introduce and discuss the different integrated concepts you derived from the set of possible functional solutions.

7. Concept Selection and Justification

In this section, the selection of your (final) concept is to be discussed. Feel free to use appendices to include additional details.

a. Discuss the selection process used to identify the promising concept(s) to be designed further. Use a decision-matrix type approach, evaluation matrices, etc.
b. Perform an initial evaluation of the (selected) concept(s)' feasibility with respect to the design specifications.
c. Document quantitative analyses used to confirm feasibility.
d. Discuss potential risks and countermeasures that you foresee at this point.
e. CAD model of preferred design.

8. **Industrial Design**
    a. Discuss how Industrial Design considerations informed your design.
    b. Discuss how visual hierarchy and language are integrated in your design.
    c. Discuss ideation results on branding, concepts, logo, textures, and colors to reach the target demographics.

9. **Engineering Analyses and Experiments** (details may be an Appendix).

This is a very important section because it "proves" that your design works from an engineering and physics perspective in a quantitative manner. It should include material (strength, failure, etc.) analyses and any other engineering analysis that are relevant to your design (like power and energy analyses, free body diagrams with forces and torques, thermal analyses, etc.). Discuss simplifying assumptions, boundary conditions, and mesh diagrams as appropriate.

    a. Describe the design analyses (including any experiments) to be performed to ensure the design meets specifications.
    b. Describe the analyses and experiments already performed and results. Use a subsection to describe each specific analysis. Details of each analysis may be in an Appendix.

10. **Mockup and Prototyping**
    a. Discuss any mockups and prototypes made, including the purpose for each and learning obtained from each.
    b. Discuss the purpose for prototyping, the prototyping strategy employed, and how you evaluated each prototype.

11. **Societal, environmental and sustainability considerations**

Use the "Social Impact Assessment" methodology to explore the impact of your design/product. Use the lecture materials and guidance documents available from the MECapstone website.

12. **Team Member Contributions**
    a. Describe the specific responsibilities and individual contributions of each team member.

13. **Summary & Future Work / Project Deliverables**
    a. Summarize accomplishments and discuss next steps.
    b. Discuss substantive conclusions about the design challenge and solutions.
    c. Provide and discuss a project plan and timetable with milestones for remainder of this semester (include a well-detailed Gantt Chart)
    d. Discuss how team has been and will be communicating with client(s), advisor, sponsor (if applicable) and any other stakeholders to keep them informed.

14. **References/Citations**
    a. Provide a list of properly cited literature and electronic sources, ordered in the sequence the citations appear in the text. Anything listed here must have been explicitly cited in the text.

Appendices (as needed)

Reference material and detailed calculations should be placed here. Use multiple Appendices (Appendix A, B, C, etc.) as appropriate to group material of like kind or subject matter into their own appendices. Each Appendix must be explicitly cited in the text. Do not use the Appendices as places for figures; those should be in the main body of the text. Be aware that you're producing an electronic document, so you may take advantage of such to alter the layout of individual pages/sections within the text (e.g., large, landscape figures may be directly within the text if the page/section formatting is handled properly).

Deliverable #2 – Initial Drawing and Fabrication package

This is a separate document, formatted appropriately as would be used to provide to a manufacturer or fabrication shop. This is a drawing set, so all content should share a common size and format; for example, the index would be on a drawing. There is no "cover page" per se. The drawing package must be contained within a single file (e.g., a single multi-page pdf).

a. Provide a detailed index to contents of fabrication package (including drawing index).
b. Provide an initial Bill or Materials and/or parts lists including vendors, part numbers, and prices.
c. Typically, an assembly drawing should appear as the first drawing within the set, and serves as a reference for part names, part numbering, etc.
d. Provide a preliminary CAD and part drawing(s) of the design, including tolerances, dimensions, etc. for each manufactured component. GD&T is valuable here!
e. The title block on each drawing, in addition to the usual information, should include the name(s) of the team member(s) principally responsible for the design of the part(s) on that drawing.

Note: For report #2, your team may not have significant content within the fabrication package; that's fine. However, it is helpful to at least generate the structure and "placeholder" content for the package.

Deliverable #3 – Team Presentation

The project progress presentation contains the same basic information as the written report except it is primarily visual and oral. However, do not repeat the information given in Presentation #1. Instead, briefly remind the audience what the project is about, its motivation, and the state of the design as previously; then segue into the current results which form the bulk of the presentation.

- Use bullet points, charts, photos and drawings. Do not display detailed formulas and calculations unless essential to convey a design point, support a decision, etc.
- Consult your instructor about the number of speakers. Recommended practice is for one or two speakers to present. Feel free to have group members respond to specific audience questions as necessary.
- Plan for a 15-minute presentation plus questions.

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BASIC STANDARDS FOR WRITTEN TEXT

(NOT exhaustive, the use of good practices is expected)

Report Format

- Use a common font throughout, 11 point type, 1.5 line spacing, with 1" margins on all sides
- Put headings in boldface, leaving a blank line BEFORE each heading.
- Section and sub-section headers must include a hierarchical outline-numbering scheme.
- Pages should be numbered at bottom of the page. No number on title page.
- The title page is not numbered. The Table of Contents, Executive Summary, and Nomenclature are numbered "i", "ii", etc. The main body is numbered 1, 2, etc. starting with the Introduction.
- Appendices typically are labelled with a letter: A, B, C, etc., with each appendix containing material for only a single topic. Appendices' pages may be numbered sequentially with the main text, or with an appendix-specific number such as A-1, A-2, …, B-1, B-2, …, etc.

Figures and tables

- Do not place all the figures and tables at the end of the main body.
- Figures, sketches, tables, photos may be attached in addendum only if they are of a size that precludes them from being in-line where referenced in the text; but, be mindful that you're producing an electronic document, so that you may alter the layout of pages/sections so that large figures are in-line. Large figures or tables may require separate pages, or as a last resort, inclusion in an Appendix. For landscape layouts the top of the figure or table should be at the binding margin.
- All figures and tables should be clearly labeled, dimensioned, and captioned. Captions should be placed at the bottom of figures and at the top of tables.
- Cite and discuss all figures and tables in the text.
- Number figures and tables in the order of appearance. For figures and tables placed in the appendix, keep them separated into two categories for each appendix, and the Appendix label must appear in the captions (e.g., Table A-1, Figure A-1, etc.).
- Provide fully descriptive captions for all figures and tables following the numbering. "Fully descriptive" means that the captions and headings speak to the specifics of the item and its context for your project. "Function Tree" is not fully descriptive; "Function Tree for printing of fiber reinforced concrete with aligned fibers" is fully descriptive.
- Place figures and tables at the end of a paragraph where first mentioned or optionally at the top or bottom of the same page, or top of next page. Do not break paragraphs to insert figures and tables.

Technical

- Do not put extensive formulas or calculations in the main body of the report but instead use an appendix. Only include equations necessary to support decisions and direction.
- Clearly reference sources of data, formulae, and information used.
- Use the proper number of significant digits to reflect the accuracy of numbers.

Editing and style

- Proofread, proofread, **PROOFREAD!** Do this with the point of view of someone that is unfamiliar with the project; the only information they have is what you are telling them so a logical order and sufficient context are essential. Your section instructor is NOT your editor!
- The document must be a coherent whole, not a pastiche of individual efforts.
- Ensure that individual "authors" do not evidence themselves by changes in format, prose, structure, redundancies, etc.
- Use present tense wherever possible. Students tend to use past or future tenses because work is already complete or it hasn't been done yet. Instead, imagine viewing the work and describe it. Sometimes past or future tense is most appropriate, just use it judiciously and avoid mixing tenses within paragraphs.
- Use third person. Only use "I, we, us, you," or "our" in special circumstances, such as in a preface or acknowledgments.
- Don't use quotation marks ("xxx"), unless you are quoting what someone has literally said or written.
- State the obvious, but avoid unwarranted redundancy; your audience does not know what you know about your project. What is obvious to you may not be obvious to them.
- Write cleanly and concisely. Delete words that add little meaning and impede flow. Rephrase. Do misplaced details obfuscate the main point?
- When in doubt, do without.

SCORING/GRADE

In general, the oral presentation represents 2.5% of the team grade (5% as an individual presenter), and the written report is 15%, but these are all subject to individual faculty discretion.