Documentation and Reporting

Project Notebook

Description & Requirements

Each team will keep a notebook (a 3-ring binder) documenting their progress in the building of their project. Information about both chip designs need to be included throughout. The purpose of the notebook is to document your work and maintain a record of ideas and decisions made throughout the quarter, in order to create your final written report and oral presentation. Your TA or instructor will check this notebook each week in lab as it counts as part of your grade. The notebook will be turned in the last day of class, along with your final written report.

[Note that if the Project Description Document is referred to anywhere in the notebook or Final Report, it must be cited appropriately]

What to include in your notebook:

- **Note:** All of these items must be included in a 3 ring binder with labeled tabs separating the sections

1. **Table of Contents:** The table of contents should reflect some organizational structure. In the past, notebooks have been organized by type of document (e.g. sketches, meeting notes, lab reports, etc…) and also chronologically. This section should be typed and page or section numbers should be provided. Major items in the Table of Contents should correspond to tabs in the Project Notebook. Minor items in the Table of Contents may be listed under the major items if necessary for quick reference.

2. **Team Working Agreement:** Your signed team agreement, completed to be specific to the LOC project.

3. **Project Schedule:** Your project schedule should be a working document. Each week your schedule should be updated to reflect changes, additions, and modifications.

4. **Graded Lab Memos and Final Report:** Simply include all lab memos after they have been graded, plus the final written report.

5. **Lab Tour Summary**

6. **Design Documentation:** Initial sketches, 1st and 2nd designs and drawings along with all calculations and operational processes for both designs.
7. **Meeting Notes/Brainstorming Record**: Your meeting notes should accurately reflect the topics discussed and decisions reached (or not reached) in your team meetings. Sketches (if any) should accompany these notes.

8. **Sketches**: The only sketches required here are those not already contained in team meeting notes or lab reports. You should include any free hand or draft CAD drawings outside of the meeting notes or reports, including scrap drawings or ideas not used.

**Project Notebook Grading Guidelines (how the notebook will be graded)**

The purpose of the project notebook is to document all work undertaken by the team during the course of the semester. When submitted, the project notebook should contain all the information required for the implementation of the project, in a step-by-step or sequential fashion. The project notebook is worth 40 points and the distribution of points and grading guidelines are listed below.

1. **Notebook Organization (5 pts)** – Use a three ring folder or binder. One approach is to place all project related documents from ENGR 1182 in the Project Notebook, tabbed for easy reference, with each tab labeled with the section’s contents (e.g. Tab 1 is labeled “Table of contents,” Tab 2 is labeled “Team Working Agreement,” Tab 3 is “Project Schedule,” etc.). Throughout the class period the staff will check the Project Notebook to make sure that it is up-to-date.

2. **Grading (20 pts)**
   - Table of contents and proper page numbering (5pts)
   - All lab related assignments, memos, and final written report (5 pts)
   - Brainstorming ideas, final design and related sketches, calculations and out-of-class meeting notes (10 pts = 2 + 3 + 2 + 3) – All sketches should be neatly labeled and titled. Sketches of all designs will use Solidworks; fully dimensioned top views should be furnished.
     - Brainstorming ideas – 2 pts
     - All Designs and related sketches – 3 pts
     - All Designs calculations – 2 pts
     - Out-of-class meeting notes – 3 pts

**Timely submission – Each team needs to submit the Project Notebook at the start of the oral presentation session.** Any late submissions are subject to a 30% deduction.
Final Report

This section provides some information on what should be included in each part of the team’s report, along with some hints or examples that might be helpful in preparing that part of the report. Each part of the report is covered in a separate subsection. Do not copy and paste text from your lab memos into the report, but use them as reference for information.

Cover Page
Include

- Project title
- Team name and number
- Names of team members
- Course name and number
- DATE!!!

Hints
- Use a design or team letter on the cover page.

Table of Contents
Include

- Number of each part or section
- Part or section titles
- Page on which each section begins

Hints
- The page number for the Table of Contents is "i".
- If a section is several pages long, in the Table of Contents, give only the number of the first page of the section.
- Look in some published reports or books for examples.
- From the Microsoft Word menu, use "Insert", "Reference", “Index and tables…”, then click on the “Table of Contents” tab. This is the easiest and neatest way to create this section. You can also use it to update page numbers and heading names in the Table of Contents on command as you make changes to the body of your report.

List of Figures (Drawings)
Include

- Figure number
- Figure title (as it appears in the caption on the figure)
- Page on which the figure is found

Hints
- Assuming that the Table of Contents is only one page long, the List of Figures is on page "ii".
- Look in published reports or books for examples.
- From the Microsoft Word menu, use “Insert”, “Reference”, “Index and tables…”, then click on the “Table of Figures” tab. This is the easiest and neatest way to create this section. You can also use it to update page numbers and heading names in the Table of Contents on command as you make changes to the body of your report.
Executive Summary
This portion of the report is a very concise rehash of the entire report from the Introduction to the Conclusion. It can be used by a manager in a hurry to get a high-level understanding of the report without having to wade through many pages of detail. It is very brief, yet comprehensive in that it covers the following:
- Problem Statement
- Discussion of the design process
- Final design descriptions
- Final design performances
- Potential improvements.

Introduction
This part of the report has three main purposes.
- Problem Statement: First, it tells the reader exactly what problem is being solved or what piece (or pieces) of equipment will be designed.
- Significance of the project: Next, it explains to the reader why this work is important.
- Organization of the report: Finally, the last paragraph of the introduction gives the reader a "road map" to the report by describing the organization of the report, stating the sections that follow and a brief statement regarding each section’s content. For example, the last paragraph might contain sentences such as, "Section 2 contains the requirements and constraints the design must meet." or "Description of the preliminary paper design is presented in Section 3. ", if section numbers are used. Otherwise, this last paragraph would, in a similar fashion, only list the section titles in place of the section numbers, along with a brief statement about the contents.

NOTE: Very few people read a report from cover to cover. They scan the introduction to see whether the project being described is of interest to them. If it is of interest, they might check the "Organization of the Report" to see which section will provide the information they are seeking.

Requirements, Constraints, and Information Needs
How does the sponsor, i.e., the person who paid for the project, decide whether the design is acceptable? He or she makes that decision by determining whether the product meets all of the requirements and can be produced within the constraints. This section describes the requirements and constraints that will be used to judge the design. In it, team members also identify any additional information they will need to gather in order to design an acceptable product. Examples of a requirement, a constraint, and information need follow. Your report will need to include the following:

- Requirements: specific features that the design must have (e.g., performance specifications)
- Constraints: factors that limit design options (e.g., size, budget, material, etc.)
- Information needs: data that must be collected to evaluate proposed designs (e.g., test or calibration data)
Example:
Suppose a team is to design a child's car seat that converts into a stroller.
A requirement might be that the seat be light enough for one person to lift easily. However, a constraint, at least here in Ohio, is the law that any child weighing 45 pounds or less must be in a car seat while traveling in an automobile. The car seat must, therefore, be strong enough to support a 45-pound child, and that certainly could affect the weight of the car seat. As a result, two information needs might be the density and strength of a variety of materials that could be used in a car seat.

1st Chip Design Concepts and Analysis
The reader will turn to this part of the report to learn about the team’s 1st chip design. Some readers will learn more by reading a written description, some will prefer an illustration, and still others will use both. Thus the team must provide both, a clear written description and illustration of the concept and a stated link between the text and the illustration.

The team reports on the 1st chip design and the actual design progression, in light of the requirements and constraints, and on its 2nd chip design decision. The reader should be able to follow the team’s reasoning as it accepts or rejects all or parts of each concept and selects a final design. In addition, the team will describe any refinements to the design (include all relevant revisions to illustrations) and the reasons for them. All calculations (including MATLAB, Excel and paper-based calculations) should be presented. You will include the following:

- Introduction to the section
- Discussion of 1st chip design and its detailed mathematical justifications
- Discuss how the feedback was incorporated
- Changes made to the 1st chip design concepts and their revisions in light of the requirements and constraints
- Selection of the 2nd chip design
- Justification of the selection based on requirements and constraints

Hints
- Think of the written description of as what a team member might say in a telephone conversation with a potential customer who has asked for a description of the design. The goal is to paint a "mental picture" of the concept.
- The concept should be described in detail.
- Stick to the facts. This is not an advertisement. It is a formal, professional report.
- Include illustrations of the concept as and when needed.
- Refer to the illustration in the text so that the reader knows the illustration is available. Here are some examples of references to an illustration: "The three-wheeled stroller, shown in Figure 3.5, is..." or "One unique feature of this concept is the detachable canopy. (See Figure 3.7.)"
- Illustrations should follow the paragraph in which they are first mentioned, if the illustrations occupy less than a full page. If an illustration requires a full page, it should be on the page following the one in which it is first mentioned.
• Each illustration (figure) should have a number and a title. For example, “Figure 3.5. Three-Wheeled Stroller/Car Seat Combination in Stroller Mode.”

2nd Chip Design
If the reader turns to this section first, he or she should find a written description of the 2nd chip design that provides a clear "mental picture" of the design. That description should be followed by a complete Solidworks drawing of the design. At the end of the description, be sure to tell the reader that the working drawings follow. Include the following:
• Introduction to the section
• Description and comparison of the designs
• Accompanied CAD/other drawing Summarize the paper and actual design progressions
  i) Show design calculations for at least one feature.
  ii) Briefly summarize the other features in one of your designs with respect to volumes, flow rates, flow lengths, assumed maximum sealing pressure, etc., from your 2nd Chip Design documentation

Circuit Analysis
In this section, teams should include a schematic of the circuit employed and the rationale behind why that circuit is used. Teams should discuss the advantages and disadvantages afforded by the particular circuit and other possible variations as well as discuss proposed improvements to the circuit. Include the following:
• Circuit Schematic
• Brief working of the circuit
• Suggestions for using alternative circuits (general)
• Proposed improvements to the circuit (general)

Performance Analysis
This section is for the reader who simply wants to know the "bottom line" - what happened in the project, why it happened, and what the team learned from the design project experience.
• Introduce the section
• Tell the reader how your team’s system performed (sometimes a table of data with a discussion of the most important information in the table is effective).
• Discuss the reasons for the performance of your team’s design
• Identify the tasks your system performed as expected and mention any problems encountered.
• Discuss why the problems occurred and what could be done to solve them.
• Compare the performance of the two designs, and if one works better than the other, discuss why.
• Hint: Include and use your collected excel/testing data to analyze your chips’ performance.
Fabrication Issues
This section considers current fabrication process issues and the future of the manufacturing of the device if it was "ramped up" for production or scaled down to the nano. Include the following:
  - Introductory paragraph
  - Discussion on how prototype was fabricated and type of fabrications methods employed
  - Discussion on how fabrication process affected chip performance and possible improvements to this process
  - Discussion on necessary design changes to make chip truly portable, including fully interfaced detection system
  - Discussion on issues likely to be encountered when scaling the device to the nanoscale. Discuss issues with respect to manufacture, sensing, fluidics and functionality.

Summary & Conclusion
Finally, in a paragraph or two summarize what the team learned from the design project. The "lessons learned" could be related to technical components of the system, communication skills, teamwork, or any other aspect of the course. Include things you will want to remember to do in the future as well as things you want to avoid. You may include the following:
  - Summary of report contents
  - Suggestions on improvements on the design process and the project as a whole
  - What the team learned from this design project; things team members want to remember to do in the future, and things they want to do differently.

Grading Guidelines
The grading guidelines sheet (below) should be attached to your final report.

More Tips
Some tips on report preparation could apply to more than one part of the report:
  - The report is a formal, professional document. It is not advertising copy. Use formal language. Choose words carefully. Be accurate. Do not exaggerate.
  - The audience for this report is a group of engineers and their managers who must first decide (on the basis of the written report) whether your design is the best one for their needs. Then, if it is the best, they must be able to build your design using only the information provided from your report.
  - Don't use first person (I, me, my, we, our) or second person (you, your). Refer to the writers of the report as "the team", "team members", etc. Sometimes, it may be necessary to use passive voice to avoid using first person.
  - Provide as much detail as is necessary to describe the project but be as concise as possible. Be considerate of the reader. Don't waste his or her time. If a word does not provide new or important information, leave it out.
  - Use 1 1/2 or double line spacing.
Number the pages. The Title of Contents is on page "i", the List of Figures is on page "ii", and the first section "Introduction" begins on page 1.

Use headings and subheadings to help the reader follow the organization of the report or find the section of interest. Section titles should be the same as those in the Table of Contents. If a numbering system is used for headings and subheadings, it should be the same as the one in the Table of Contents.

**Tips on Figures**

Few students have experience putting figures in reports. But in technical reports, figures are often very important. The reader must be able to locate the figure and quickly understand how it is related to the text. Here are some tips on figures.

- A figure should have a **number and a descriptive title** (also called a *caption*). Some examples follow.
  - Figure 1. Multiview drawing of the three-wheeled stroller concept.
  - Figure 7. Graph showing densities of various stroller construction materials.
- The figure number and title in the List of Figures should be the same as the number and title in the body of the report.
- Each figure should be **described and referenced** in the text so that the reader knows to look for the illustration.
- A figure should follow the paragraph in which it is first mentioned, if the figure is small, or follow the page on which it is first mentioned, if the figure requires an entire page.
- Horizontal figures should be put in the report so that the top of the drawing is on the left and the bottom is on the right. Be careful that the margins are wide enough that the entire figure, including its title, is visible when the report is bound.
### GRADING GUIDELINES

**DOCUMENT GRADED:** FINAL REPORT

**TEAM DESIGNATION:**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>POSSIBLE POINTS</th>
<th>POINTS EARNED</th>
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<tbody>
<tr>
<td>TABLE OF CONTENTS</td>
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<tr>
<td>LIST OF FIGURES &amp; TABLES</td>
<td>5</td>
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<td>EXECUTIVE SUMMARY</td>
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<tr>
<td>INTRODUCTION</td>
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<tr>
<td>MAIN BODY: CONTENT</td>
<td>70</td>
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<tr>
<td><strong>THE FOLLOWING NON-GRAY CELLS</strong></td>
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<td>Requirements, Constraints &amp; Information Needs</td>
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<td>1&lt;sup&gt;st&lt;/sup&gt; Chip Design Concepts and Analysis</td>
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<td>2&lt;sup&gt;nd&lt;/sup&gt; Chip Design: Description</td>
<td>10</td>
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<td>CAD/other Drawings: 2&lt;sup&gt;nd&lt;/sup&gt; Chip Design</td>
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<td>2&lt;sup&gt;nd&lt;/sup&gt; Chip Design Analysis: 1. Show design calculations for at least one feature; 2. Summary of other features; 3. Justification of 2&lt;sup&gt;nd&lt;/sup&gt; Chip Design</td>
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<td>Circuit Analysis: Description &amp; Circuit Schematic</td>
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<td>Performance Analysis</td>
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<td>Fabrication Issues</td>
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<td>SUMMARY &amp; CONCLUSIONS</td>
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<td>OVERALL EFFORT &amp; EFFECTIVENESS</td>
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The following non-gray cells represent the breakdown of the 70 points allotted for MAIN BODY: CONTENT. Bolded lines are sections of your report. Non-bolded lines are requirements within that section.