

ENGN 378 and 379

Capstone Design

Fall and Winter Report Template

Introduction

This section should give an unfamiliar reader the background information they need to understand the report while also being relevant for a familiar reader who might be skimming through on their latest update on the project. These reports are intended for your client, which might imply a narrow audience, but this is not the case. Some members of the client's firm will be keenly aware of the technical details, others will only be aware that the project exists. You must aim to satisfy both readers. In addition, the client might share this report with other partners, or your firm might present this report to future clients, so it must be able to reach a broad audience while remaining diligent to the technical details. At a minimum, this section should address the following:

- Background and motivation – Why is this problem important to solve?
- Stakeholders – Who is directly, indirectly, or potentially affected by the problem or by the solution you are proposing?
- Market Analysis – How does your solution fit into the current economic market?
- Formal problem statement – What precisely are you trying to solve?

Design Process

Some readers will want to know the steps you followed to determine the optimal solution. Others will want to see what was tried and what was learned. Others will be interested in what factors you considered important while making decisions and how those factors affected the decision making process. This section will range from prose narrative to technical nomenclature, and this transition should be seamless. At a minimum, this section should address the following:

- Outline of design process – How were each of the items listed in this section incorporated into your process? How was prototyping and testing incorporated? How did you incorporate relevant information from the Introduction?
- Timeline for the design – Successful teams have a detailed timeline. The timeline should be consistently updated throughout the year and the most recent version inserted into any report.
- Objectives for design solution – What does your solution seek to optimize as it solves the problem?
- Functions for design solution – What must your solution accomplish? What must it do?

- Requirements for and constraints on design solution – What limits are there on the operation of your solution? What are the necessary amounts for each function that the solution must provide?
- Cultural factors – How does your solution meet the needs of all the stakeholders involved?
- Environmental factors – How does your solution meet the goals for sustainability and impact?
- Economic factors – How does your solution exist within the market that you outlined?
- Ethical factors – How does your solution hold paramount the health, safety, and welfare of the public? Who is your public?

Prototypes, Testing, and the Final Product

This section will present the construction, experimental testing, mathematical modeling, analysis, and the revisions that resulted in the most recent final product. This section will be different for the fall than the winter term because prototyping and refining are different processes. In the fall, testing might be focused on learning whether a solution method is worth considering further because the first iteration showed promise (i.e., can a spring make this move?), whereas in the winter, testing might be focused on a specific, chosen solution that needs to be refined (i.e., do I need a spring constant of 45 N/m or 50 N/m?). By the end of fall, you should have created several prototypes, developed rigorous testing methods, analyzed operation and compared to predicted operation, and produced evidenced-based reasons for revisions that lead to the most recent prototype. The final prototype of the fall should give substantial promise that a solution can be obtained. By the end of winter, you will have completed prototyping several weeks ago, and you should be asymptotically approaching a final marketable product. The second half of winter term is aimed at refining a final solution, which means that trying new solutions should no longer be on the agenda. At a minimum, this section should address the following:

- For the fall:
 - Documentation of all prototypes and methods of construction
 - What was made, how was it made, what did you learn from the construction and from the testing of each prototype? How did each prototype improve upon or expand from previous prototypes?
 - Testing protocols
 - What is your system designed to do?
 - What specific physical quantities will you measure to assess system performance? Why did you pick these quantities?
 - What instruments, equipment, or software will you need to make the measurements?
 - How many replicate measurements do you need to assess system performance? Justify this answer.
 - How will you analyze the data? How will you interpret the data?

- What models or theoretical predictions do you have for comparison?
 - How can you present the data for both a technical audience and a broader audience?
 - Preliminary results relevant to each prototype
 - Midyear solution
 - What is your midyear solution for the fall term?
 - How does the midyear solution fall short of the final marketable product you are planning to produce?
 - What needs to be accomplished in the winter term to bring this to a final solution?
 - Bill of materials and cost estimate
 - What will it cost to make the latest prototype? What might the final winter product cost?
- For the winter:
 - Documentation of final product and methods of construction
 - What was made, how was it made, what did you learn from the construction and from the testing of each prototype? As relevant, how did each prototype improve upon or expand from previous prototypes?
 - Testing protocols
 - What is your system designed to do?
 - What specific physical quantities will you measure to assess system performance? Why did you pick these quantities?
 - What instruments, equipment, or software will you need to make the measurements?
 - How many replicate measurements do you need to assess system performance? Justify this answer.
 - How will you analyze the data? How will you interpret the data?
 - What models or theoretical predictions do you have for comparison?
 - How can you present the data for both a technical audience and a broader audience?
 - Final results for the final solution with results for earlier prototypes presented as relevant
 - Final solution
 - What is your final solution for the winter term?
 - What refinements were made from earlier prototypes? Briefly review important milestones during the prototype phase: what was made, how was it made, what did you learn from the construction and from the testing of each prototype? How was each prototype improved upon or expanded from previous prototypes?
 - How does the final solution fall short of the marketable product you were planning to produce?
 - What needs to be accomplished to bring this to final solution to market?
 - Bill of materials and cost estimate
 - What will the final solution cost?