INTERIM DESIGN REPORT GUIDELINES

End of First Semester Written Documentation for Capstone Engineering Design Projects

PURPOSE AND CONTENT
The interim design report is the official statement of status for the project client. As such, the report must effectively communicate the credibility and value of a design concept to decision makers. A credible conceptual design proposal should document the extent of conceptual design efforts, processes used in concept selection and development, key features of the proposed product concept. The quality of the report’s content and presentation will make a statement about the design team’s professional competence, its attention to detail, and therefore, the credibility of the proposed conceptual design.

LETTER OF TRANSMITTAL
The detail design report is submitted to the client and other important stakeholders with a cover letter or letter of transmittal introducing the report. The letter is addressed to the proper decision maker(s), states the purpose of the report, and asks for specific actions. It provides instructions for obtaining additional information and for communicating a response to the design team. The letter of transmittal is especially important to readers who did not benefit from an oral presentation on the design.

Key features:
• Addressed to sponsor and other interested parties
• Says “here’s an (interim) report on the XYZ project
• Thanks addressee for help provided to date

COVER PAGE
The cover gives readers their first impression of the design product, its quality, and its impact. The cover should principally identify the product and its intended purpose. It should also present names of team members and/or their group/firm, the report’s intended audience, and date of preparation. Because its visual impact is important, the cover should use images and words strategically to communicate attractive features of the product and/or team or to highlight values radiated by the product. An excellent product will have a professional cover page and/or packaging for the report.

Key features:
• Title
• Authors
• Contact Information
• Sponsor Logos
• Interesting Picture
FRONT MATTER

The front matter in a formal report includes an Executive Summary and Table of Contents. Typically, the Executive Summary appears first to catch the reader’s attention and to prepare the reader for the substance of the report. The Table of Contents presents an outline of the report and page numbers to guide the reader to sections of interest.

Table of Contents
• Uses Numbered Sections (1.0 …) and Subsections (i.e. 1.1 …)
• Includes Informative Labels
•Enumerates Appendices along with Labels (A …, B…, C…, etc.)

Executive Summary (up to 1 page)
The Executive Summary is intended to motivate readers to study the full design report. It should present a short, powerful synopsis of the report, highlighting important needs, presenting key features of the proposed solution, and delineating noteworthy benefits of the solution. It should be less than one page in length and address issues of greatest interest to decision makers— notably, the principal technical and business merits of the design product—and should recommend appropriate next steps for adoption of the design product.

Key features:
• Intro sentence => what are you designing and who are the stakeholders
• Needs sentence => what are the key customer needs
• Methods sentence(s) => what alternatives were considered/selected
• Results sentence => what features and test results were obtained
• Discussion sentence => what benefits/merits are derived from the design
REPORT BODY

The body of the report contains an organized presentation of the design product and crucial steps in its development. The body should include selected background information, principal design processes and decisions, noteworthy features of the design, and defensible evidence of design decision making. Extensive supporting documentation should be deferred to an appendix or separate volume.

Background (1 page)

The Background section explains the problem need and its context. This section describes the scope of the need, identifies stakeholders who are affected, and describes benefits that can accrue from a responsive, viable design solution. This section should present data to document the need and potential benefits from a solution.

Key features:
- Provides motivation for the work
- Summarizes prior work by sponsor
- Identifies need/opportunity
- Describes expected benefits

Problem Definition (1-2 page)

The Problem Definition section states the specific design requirements (product attributes or performance expectations) satisfied by a high quality design solution. This section includes a succinct list of project requirements with measures or indicators that these have been achieved. The requirements and measures often appear in tabular form, supplemented by a brief discussion in the body. This section should identify constraints that limit the design solution, possibly including: economic, environmental, sustainability, manufacturability, ethical, health and safety, social, and political.

Key features:
- Problem statement/goals
- Table of specifications
- Discussion of key constraints
- Identify key sources for project learning
- Deliverables

Concepts Considered (3 pages)

The Concepts Considered section describes the landscape explored by the design team in its search for creative solutions. It should address both original ideas and those derived from other sources. It should summarize the scope of ideas considered and highlight the most creative and relevant concepts for the overall solution and for its component parts. Because this section reflects the effort of the design team to identify relevant solution ideas, it communicates a message about the team’s expertise and its effort invested in this project. Additional engineering analysis, test results, and prototypes may be reported.
Key features:
• Can be done at a sub-system by sub-system level (from functional map)
• Explore original ideas + those derived from other sources
• Quantitative data (from preliminary experiments, calculations, or prototypes)
• Include illustrative sketches/drawings/diagrams
• Include morphological charts as appropriate

**Concept Selection (1 page)**
The *Concept Selection* section describes the processes and rationale used for selecting the “best” concepts for the overall product. It may include summary tables comparing concepts against design criteria (e.g., decision matrices) or summary evaluations of specific concepts.

Key features:
• Quantitative data (from preliminary experiments, calculations, or prototypes)
• Include morphological charts and decision matrices as appropriate

**Selected Design (2 pages)**
This section describes the selected product concept with its overall architecture and component integration in more detail than the concepts considered section. This section also includes an estimate of costs for realizing the prototype and financial benefit to the client. If available, results from component testing or analysis are presented to defend performance claims. Overall, this section must make a convincing case for the technical and functional merits of the conceptual design.

Key features:
• Describe system design in more detail
• Describe integration of components, including user interface
• Highlight novel features and their relation to specs – your “value added”
• Statement costs incurred and estimate of future project costs

**Future Work (1/2 page)**
The *Future Work* section sets forth a clear plan for deliverables and a schedule to achieve them next semester. Any unresolved issues should be highlighted at this time such as re-scoping of the project from original description. This section should provide details on the anticipated work schedule and milestones for the next phase of the project. If specific approvals or authorizations are needed for project continuation, this section should request these.

Key features:
• Description of the second semester work plan
• Requests for approval and authorization

**APPENDICES**
Appendices are used to present supplemental materials that support the report body but are too lengthy or have less refinement than those contained in the body. These may be calculations,
drawings, lists, computer programs, tables, figures, or narrative. Each appendix should be self explanatory, and each should be referenced in the report body where appropriate. Special sections should be included containing the following items:

Key features:
• Calculations
• Drawings
• Computer programs
• Long tables/figures
• Vendor data sheets
• Operating Manuals/Procedures
MEASURES OF REPORT QUALITY

The quality of a conceptual design report is determined by its impact on the client and project supervisor. The report must build a compelling case for continuation of the product development effort and leave no doubts about the value of the product or the potential of the design team to deliver the contracted product within the allowed time and budget. The report must present a high quality product in a very professional manner. Specific criteria for assessing the report are defined below.

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>Score = 1</th>
<th>Score = 3</th>
<th>Score = 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OVERALL REPORT QUALITY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weak case for continued product development; conceptual design is incomplete or meets few design requirements; little or no evidence justifying product financially; report is incomplete, unattractive, can be misunderstood, has distracting errors</td>
<td>Credible case for continued product development; sound conceptual design meets most design requirements; some indication that product will be economically feasible; report is complete, understandable, attractive, nearly flawless</td>
<td>Excellent case made for product continuation; innovative and competitive conceptual design meets all design requirements; credible evidence that product will be financially successful; report is very complete, flawless, very clear, compelling, beautiful</td>
<td></td>
</tr>
<tr>
<td><strong>BACKGROUND</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identifies basic client needs for product; acknowledges few existing products or resources that may influence the development of a solution</td>
<td>States problem context relative to clients and the state of technology within society; reviews most important literature, patents, competitive products</td>
<td>Describes and analyzes problem context in terms of clients' needs, societal and global issues; thoroughly analyzes literature, patents, competing products</td>
<td></td>
</tr>
<tr>
<td><strong>DESIGN REQUIREMENTS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Few design requirements defined; most are loosely defined, performance-related, qualitative; few or none based on documented client needs; broader considerations* neglected</td>
<td>Defines important design requirements based on primary and secondary clients; addresses technical and non-technical requirements and constraints*; many measurable requirements</td>
<td>Skillfully defines comprehensive design requirements based on needs of clients and stakeholders; addresses system-level and life-cycle requirements and constraints*; all are measurable</td>
<td></td>
</tr>
<tr>
<td><strong>CONCEPTS CONSIDERED</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited number of useful concepts; do not reflect knowledge of state-of-art; little creativity</td>
<td>Useful concepts for components and overall; reflect knowledge of state-of-art for at least some parts; some show moderate creativity</td>
<td>Many useful concepts for components and overall; reflect knowledge of state-of-art for all components; significant creativity</td>
<td></td>
</tr>
<tr>
<td><strong>CONCEPT SELECTION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vague process to select concepts; little record of decision making process; poorly-defined criteria</td>
<td>Rational, documented process to select concepts; clear measurable criteria in making design decisions</td>
<td>Quality client-focused process for selection; fully documented; clear quantitative, qualitative criteria</td>
<td></td>
</tr>
<tr>
<td><strong>SELECTED DESIGN</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product features lack client-focus; performance not linked to design requirements; no integration; Vague estimates of product costs</td>
<td>Product evidences client-focus; meets key design requirements; some system integration; Reasonable estimates of costs and value to client</td>
<td>Product delights client; fully meets design requirements; components skillfully integrated into whole; Reliable estimates of life cycle costs and benefits to client</td>
<td></td>
</tr>
<tr>
<td><strong>FUTURE WORK</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimal milestones and prospects for success unlikely; No cost information about solution; Risks are serious and not well understood</td>
<td>Some milestones identified and prospects for success uncertain; Solution may exceed budget; Some risks are not quantified and may compromise project</td>
<td>Milestones for next term are well defined and achievable; Solution is feasible within budget; Risks are identified and communicated</td>
<td></td>
</tr>
</tbody>
</table>

* Incorporate engineering standards and realistic constraints that include most of the following considerations: economic; environmental; sustainability; manufacturability; ethical; health and safety; social; and political.