VM450 & VE450

UM-SJTU Joint Institute Fall 2020

Design Review #3 Recommended Guidelines

Special Note

Be creative! Think outside of your box!

You are allowed to change the recommended guidelines if the change can help Judge Panel better understand your presentation and you believe you are on the right track in terms of meeting sponsors/instructors' expectation.

General Objectives

- Determine all the details of your design which was selected from Design Review #2.
- Assess the quality of the detailed design that has been created.
- Compare the analysis results with the Engineering Specifications from Design Review #1.
- Evaluate whether there have been any oversights in calculations or decisions.
- Produce and assess the manufacturing or implement plan for your proof-of-concept prototype or demo.
- Document the progresses and assure that any needed modifications have been made.

Requirements

- Oral presentation with animations and video clips for some prototyping demos
- Written report

Oral Presentation with Animations and Video Clips for Some Prototyping Demos

You will present the final detailed design to the Capstone Judge Panel. The details of your final design should be supported by modeling, analysis and perhaps some validation experiments. You should also show the progress of your prototype/demo, by including short animations and/or video clips of your design and experiments. The results should assure the Judge Panel that you will deliver a quality demo at the Design Expo.

The focus is to describe all the details of the selected design and a comprehensive analysis of how the established engineering specifications are satisfied by the selected design. Show the audience the models (mechanical CAD models or/and electrical boards, algorithms, etc) as well as quantitative results. Also describe your manufacturing and validation plans.

It's suggested that you give a background intro in the beginning of your presentation, including problem, needs, solution, and concept diagram (or flow chart). Don't assume the Judge Panel knows/remembers your previous DR presentations.

The oral presentation will be confined to **10 minutes**, **including 7 minutes for your presentation, 2 minutes for Q&A, and 1 minute for transition/preparation**. Everyone should present and the team will be graded as a whole.

Written Report

The report should be built from the previous report and documented processes. ***Please put in gray the text that remains identical from DR #1 so that the new materials become plainly obvious***.

The written design report for DR#3 should incorporate the comments of both DR#2 and DR#3 from the Judge Panel. The responses to the comments should be marked using a different color in your report. A piece of footer should also be added to show which comment the marked paragraph is addressing. Fail to mark these responses will lead to a considerable deduction in your grade.

Regardless of the project, the central elements of the Design Review #3 should include:

- Documentation of concepts generated (including brainstorming and/or the morphological charts), description of concept selection process (including concept selection matrix), and description of the chosen concept.
- Details of the selected design to a level that only with the report itself the design can be completely fabricated.
- Comprehensive engineering analysis of the design to evaluate the performance rigorously.
- Material selection and the manufacturing plan (indicating what has been finished while what needs to be completed), if applicable.
- Plan for validating the design. Please describe any experiments planned to prove the engineering specifications will be met by the experimental results.

Below is a suggested format for the Design Review #3 report. Do not force your project into this structure if it does not make sense. The goal is to write a clear, concise, and informative design report, not to follow a set format.

- Title Page
  - Have a cover page with the course name and semester, project title, team name, team number, team member listing, section instructor, and date.
- Table of Contents
  - List the major sections, along with page numbers.
- Introduction
  - Introduce the project. Discuss the background and significance of the project. The customer requirements should be "set in stone" by this point. Information sources should be seamlessly integrated.

- Engineering Specifications
  - Present all of the engineering specifications in detail using QFD. Describe your customer requirements and how you have translated them into engineering targets. Engineering targets should be well defined, numerical, and complete. It is critical to include how the QFD was developed and discuss the meaning of the QFD in the text.
- Concept Generation
  - Describe the major categories of concepts generated and the methods that were used to generate these concepts. This should include brainstorming and the morphological charts at a minimum.
- Concept Selection Process
  - Describe the methods used to select the chosen concept. In most cases, concept selection and scoring matrices should be used. In the main text show in detail the selection methods for at least your top five concepts and put the rest of the details in an appendix. Be sure to discuss the advantages and disadvantages of the top five concepts. Make a strong objective argument why the concept you have chosen is best (with respect to the customer specifications and engineering requirements).
- Selected Concept Description
  - Describe an overview of the chosen concept, using layout drawings and renderings to show how subsystems (identified by functional decomposition) interact and fit together.
  - Engineering Design Analysis
    - ✓ Analyze the specifications and discuss the engineering fundamentals that will need to be addressed to achieve the project goals. In particular, what scientific fields are involved and how are they relevant to the design problem?
    - ✓ Describe the approach that was used to determine the specific parameters (e.g., dimensions, shape, materials, variables from algorithms, functionality of circuit boards, etc.) for your design.
    - ✓ Each engineering decision should have a strong rationale behind it, such as equations or engineering logic. A way to do this is to summarize the steps you have taken to arrive at your detailed design, and discuss your engineering logic and conclusions for each step. If you felt you don't have too much to say, this means many your design decisions were made randomly and arbitrarily, which might not lead to a satisfactory grade. Since including derivations and large numbers of basic equations can be cumbersome to read in a report, put the calculations in a clean appendix. Explain the accuracy and the applicability of your calculation.
  - Design Description
    - ✓ This should include a detailed layout drawing with dimensions. All materials that will be used should be selected to the degree possible. In addition, provide a full description with drawings of the operation of your device. Software projects are required to explain their projects in sub-function using animations or flow charts if necessary. It should not only be clear what the final design is, but how it can be made, how it will work, and why it will work. List all parts used and their cost.

        - ✓ In short, the description should be detailed enough for another team to build the final prototype, using this report as a reference.
    - Manufacturing Plan
        - ✓ The manufacturing plan should include a list of materials and their associated manufacturing processes. If the prototype can be built in the machine shop, list the machine tools and operations that will be used. While a drawing with tolerances is not necessary, describe where tolerances will be important in your prototype, and where they are less important.
        - ✓ Analog to the mechanical processes, describe detailed flow charts if the core of one project is about programming and simulation. Algorithms should still be explained in detail. Please list the programming language or software and the existing source codes or libraries you are going to use. As for electrical hardware, provide detailed designs and layouts for whatever parts which will be fabricated.
        - ✓ Provide budget considerations. Is the initial budget enough for all the tasks? If not, how can the monetary problem be resolved?
    - Validation Plan
        - ✓ Describe a systematic means to demonstrate that the engineering specifications have been met. Begin thinking about all the experiments that will be necessary to prove that your engineering specifications have been met. List the engineering specifications that you will test for, and how the tests will be conducted. For those engineering specifications that will not be validated via testing or experimentation, what in your engineering analysis suggests that the specifications will be met? Is experience dictating that these specifications will be met? Be clear about (1) what it is testing for, (2) how the test will be conducted, and (3) what are the expected outcomes.
- Project Timeline and Plan
    - List / modify all the tasks and their deadlines as appropriate to achieve a successful prototyping and validation of your design, including a quality Design Expo Presentation and the Final Report. Summarize the project plan in a figure such as a Gantt chart or something similar.
- Analysis of Potential Problems
    - It is expected that you can analyze what could go wrong and how you might recover in the face of the deadlines ahead.
- Conclusions
- References
- Appendices
    - As appropriate, document major categories of design concepts generated.
- Bios

Key to a Great Design Review

- Instead of working from your personal perspective, work from that of the reader / audience. Make all points clearly. The reader should have obvious answers to most questions they might have about your project status and direction.

- Organize your reports logically and concisely. You will be graded partly on your ability to express ideas clearly with fewer words.
- Have all team members working on a single draft. This improves the flow of the writing, and avoids repetitiveness.