1. Design Documentation

Engineers are required to maintain detailed documentation of their work, not just CAD models and drawings, but also experiments, calculations, meeting minutes, and all documentation related to their project. Therefore, each project team must compile a design history consisting of your team contract, meeting minutes, team status reports, technical memos, formal documents (System Requirements Specification, Work Breakdown Structure), design presentations, CAD models, software, procurement forms, etc.; pretty much everything you create during the course of the project. This documentation must be organized in folders, etc., written to a CD, and turned in at the end of the semester along with the final written report. Each team should use some form of collaboration tools to store and share documentation.

Everything Counts: Writing style, grammar, typing, word usage, font selection, everything counts in everything you write or deliver, including presentations. This is the "capstone" of your engineering education. By now you should be able to do everything you hoped for when you started off as a freshman Mechanical Engineer.

System Requirements Specification (SRS)

We will discuss the details in class, but this is a critical design document that describes everything that your project needs to do in a formal manner. In virtually every industry, requirements documents drive the design and development process. Therefore, they require considerable effort and must translate the needs of your customer/users into quantitative technical requirements that can be tested, using specification specific language. This must include an analysis of your system requirements and how your technical specifications will address each of them. The SRS must describe **what** the system needs to do and not **how** you will meet the requirements. Sample SRS documents and a rubric for grading the SRS are posted on Blackboard.

Your design history must include documentation that demonstrates that your final system meets each of the requirements set forth in the SRS. If it does not meet a requirement, you need to explain why.

Work Breakdown Structure (WBS) and Gantt Chart

We will discuss project management and how to develop a project plan in class. The shorter the project, the more important it is to plan well; failing to plan is planning for failure. Every successful project has a well thought-out plan for "who needs to do what by when".

The Work Breakdown Structure (WBS) is a hierarchical listing of all tasks that must be performed with brief descriptions. This is foundation for building a Network Diagram that shows the order and dependencies of the tasks. These are then typically expanded into a full Project Plan that provides considerable detail for each task. Given the short

timeline for these projects, we will focus solely on preparing a complete WBS and Gantt chart. A rubric for grading the WBS is posted on Blackboard.

CAD Model/Drawings

For a Mechanical Engineer, CAD is a central part of detailed design. You will be expected to create and iterate a model of your project throughout the semester. Detailed design drawings for each component must also be prepared and included in your design history and final report. You must show a CAD model in each of your design review presentations.

Final Report

You must create a final report that will be due at the end of the semester. The report should provide considerable detail about the thought process and rationale behind the particular design approach you used, as well as explaining the details of the design. The report should include a "theory of operations" that describes the technical operation of your project. The report should include design calculations or other analysis, evaluation and selection criteria, manufacturer's data for off the shelf components, etc. Do not take all of your design documents and combine them into a single PDF and submit this as your report! See the rubric for the final report on Blackboard for details on content.

Design History CD

A CD that includes your entire design history must accompany the final report. This must include all of the documents you prepared during the project, including meeting minutes, design sketches, calculations/simulations, CAD models, as well as the final report itself, and should be well organized into directories/folders. You must include a document that summarizes how your design meets (or didn't meet) each of the requirements in the SRS.

Poster

A poster session will be held at the end of the semester to present your final project to the faculty, sponsors, and other students. Project demonstrations can be conducted during the poster session. A rubric for grading the poster session is posted on Blackboard.

2. Prototypes

Each project team is required to build and present at least two prototypes during the semester. Prototypes are built for a specific purpose, typically to demonstrate a solution to the most challenging or critical component of a system or that a particular design approach will work, thereby reducing the overall development risk. You will be required to document the purpose of the prototype and what you learned from it. For prototype #1, this will part of your CoDR presentation and should be clearly presented. For prototype #2, this should be a short technical memo addressed to Dr. Rothman. We will discuss prototyping and what is actually required for a prototype in class. The rubric for prototype evaluation is posted on Blackboard.

3. Design Reviews

Each team is required to do a Conceptual Design Review (CoDR) and Preliminary Design Review (PDR) presentation. The purpose of the CoDR is to present the requirements for you system, design concepts, and the results from your evaluating your first prototype. You should also include results and selection methodology for your final design concept. The purpose of the PDR is to present your final design in preparation for fabrication and testing. You should include your plans for both fabrication and testing, including the timeline for completion.

The final poster session should also be considered a design review presentation. You should be prepared to describe the purpose of your project, requirements, and the details of your design.

4. Status Reporting

Each team is responsible for preparing three written Team Status Reports (TSR #1-3) following the format provided on Blackboard. The goal of these reports is to summarize what has been accomplished to date and your specific plans for the upcoming status-reporting period.

Teams are also responsible for sending one person to provide oral status reports at Monday "stand-up" meetings. This responsibility must rotate among the team members.

Individual team members are also responsible for doing three teamwork assessments during the semester on CATME (an NSF website), as well as preparing an Individual Status Report (ISR) at the end of the semester that describes your individual contributions to the project.

5. Demonstration

A demonstration of your project is required at the end of the semester. This demonstration must show how your system meets the requirements in your SRS created at the beginning of the semester. There should be a written protocol or script for the demonstration. Depending on your specific project, the demonstration may not include all requirements for your system. In that case, you must include test results in your design history that shows this. A rubric for demonstration grading is posted on Blackboard.

6. Design Quality Assessment

The quality of your design will also be assessed at the end of the project. This will specifically look at the following:

- Does the design reflect the requirements?
- Does the design reflect good use of engineering principles?
- Are individual components fabricated using appropriate methods (for the budget and requirements)?
- Is the system assembled in a robust way that reflects design for assembly?
- Is there a clear demonstration that the system meets the specified requirements?

A rubric for the design quality assessment is posted on Blackboard.

7. Grading

Both individual scores and team scores contribute to the weighted overall grade. Because this is a senior design course focusing on professional practice, there are no exams. But teamwork and team success counts *very* heavily, accounting for 85% of the overall grade. See the syllabus for grading details.