The Senior Design final reports must explicitly follow the outline below.

Additional material may be added to appropriate sections, but all of the sections below, and the content indicated in each section, must be presented in the order given.

Title page

1. Title of the project
2. Date – Semester and year
3. Group number
4. Names of all group members - next to each name list the student's major and section(s) of the report for which the student was primarily responsible
5. Names of instructor(s), course number

Abstract

A very brief overview of the project's purpose and major results. May appear on the title page or at the top of the next page.

Table of contents

At a minimum must contain the headings of this outline – that is, everything in **bold** - as distinct sections of the report, with appropriate heading levels. Note that the title page and table of contents never appear in the table of contents.

1. **Introduction**
   1. Description of the project
   2. Brief description of the design solution, with illustrations
2. **Design specifications**
   1. Detailed specifications for the design. Include overall specifications for the design as well as for each subsystem and component. These are the specifications that you were seeking to meet with your design solution, and should refer to both the project description and any applicable professional standards. In particular, pay close attention to multidisciplinary specifications, that is, specifications that involve more than one field. For example, the torque and speed of a motor required in order for a particular motion to take place (mechanical) determine the power requirements to drive that motor (electrical) and the control requirements to make sure it all happens properly (computer). Refer to the design description and your design proposal, and document any changes in the design specifications that were necessary during the course of the project, in chronological order.
3. **Design overview**
   1. A non-technical overview of the complete design solution, complete with illustrations and descriptions of the function of the overall system and each subsystem.
4. **Mechanical Subsystem**
   1. A detailed description of the mechanical subsystem, including but not limited to initial sketches and concepts, theory and hand calculations (typed), complete FEA of each component, assembly drawings and the results of motion analysis. Major decisions and revisions to the mechanical subsystem are to be presented in chronological order, and must be accompanied by justifications and rationale for each change in decision matrix format. Discuss how closely your simulations matched the performance of the physical mechanical subsystem. Include a bill of materials and costs for each mechanical component. Discuss any challenges or hurdles encountered with integration of the mechanical subsystem to the rest of the design solution.
   2. Detailed engineering drawings of each component that was designed and built, as well as data sheets and/or specifications for any mechanical component that was purchased, are to be included in the appendices.
5. **Electrical/Electronic Subsystem**
   1. A detailed description of the electrical and/or electronic subsystem, including but not limited to initial concepts, theory and hand calculations (typed), complete simulation of each electrical component, circuit diagrams and analyses of the electrical subsystem. Major decisions and revisions to the electrical subsystem are to be presented in chronological order, and must be accompanied by justifications and rationale for each change in decision matrix format. Discuss how closely your simulations matched the performance of the electrical subsystem. Include a bill of materials and costs for each electrical component. Discuss any challenges or hurdles encountered with integration of the electrical subsystem to the rest of the design solution.
   2. Detailed circuit schematics of each component that was designed and built, as well as data sheets and/or specifications for any electrical components that were purchased, are to be included in the appendices.
6. **Computer/Software Subsystem**
   1. A detailed description of the computer and/or software subsystem, including but not limited to initial concepts and theory employed, complete state machine diagrams, flow charts and block diagrams that describe the function of each portion of the computer code. Major decisions and revisions to the computer subsystem are to be presented in chronological order, and must be accompanied by justifications and rationale for each change in decision matrix format. Discuss the performance of the computer subsystem, in particular the performance of sensors and actuators, as compared to your simulations and/or manufacturer’s specifications. Include a bill of materials and costs for the computer subsystem. Discuss any challenges or hurdles encountered with integration of the computer subsystem to the rest of the design solution.
   2. Complete code listings, clearly documented as either original and/or reused/altered code, must be included in the appendices.
7. **Discussion**
   1. **Technical Discussion** of the complete design details, focusing on how the design solution works and how well it addresses the design specifications of Section 4 above. Refer to the design specifications and the project proposal in the discussion, indicate which specifications were met and which were not, and how and why the final design differs from the solution proposed at the beginning of the semester. Discuss overall challenges or hurdles encountered with the physical integration of the various subsystems. An overall bill of materials and costs for the project are to be included.
   2. **Professional and Societal Context** - explicitly address each of these topics:
      1. **Engineering Standards** - Describe the process in which you searched for applicable professional engineering standards and applied them in your design.
      2. **Safety** – Discuss safety concerns that you had to address in the development and execution of your design. Demonstrate that you have the understanding that the vast majority of engineering products are used by those without technical or engineering knowledge to design and produce them, and that engineers have the ultimate professional responsibility to keep end users safe (using the broadest definition of the word "safe") by explicitly accounting for safety in design. What sort of constraints must be accounted for if the technology used in your design was used on a large scale? Are there significant environmental impacts surrounding the manufacture, use or disposal of your design?
      3. **Ethical Considerations** - Discuss your research into the various technologies that you have used in your design, and in particular any documented or potential safety or environmental issues that exist. Have you borrowed ideas from existing products or patents that may need to be licensed if the technology you developed was adopted in the marketplace? Have you borrowed ideas from other design groups and properly given credit to those ideas?
      4. **Economic factors** - Discuss any economic factors accounted for in your design. Talk about the sustainability and manufacturability of your design. How much would it cost to implement the technology and what sort of jobs would it impact (consider improvements to safety as well as potentially displacing jobs)? What sort of impact would this have on the acceptance of such technology?
      5. **Reliability** - If this technology was to be used in mass applications, what sort of reliability and failure rates would be acceptable? What safety issues would arise if the technology you developed failed?
      6. **Aesthetics** – How close have you come to producing a prototype of a marketable, viable product? What sort of additional devices or accessories could be used to make this technology as aesthetically attractive as possible while retaining its essential functionality?
      7. **Potential customers** – Describe how you have taken into account how people live and work (culturally, economically, etc) and have responsibly, consciously and professionally developed a solution that accommodates the end user? Think broadly about this question and consider applications of the general technologies you have used in your project; do not focus on the specific application you have designed.
      8. **Societal and global impact** - What would be the potential benefits to society for the applications that you developed? What would be the potential drawbacks? Are there any global ramifications to your design or the technology it uses?
   3. **Information Literacy** - Describe how, in the course of your project, you learned new things on your own, found and assessed sources of information, and the overall need to seek out and use new ideas and information to solve engineering problems, all in a responsible and professional manner.
8. **Conclusions and recommendations**
   1. Comment on the overall solution to the project.
   2. Comment on the project assigned and the process by which you solved the challenge, particularly issues with integrating the various subsystems of the physical model and including any recommendations for change or for future projects.
9. **References**
   1. Must be in proper ASME or IEEE format – list here the sources of everything that you have used in the process of your design solution that was not original to you. **Everything that is not yours – ideas, equations, concepts, photos, graphic, everything – must be documented and properly referenced**. This is major evidence of the ethical and professional manner in which you carried out your design project. All references must be properly cited in the text, and care must be taken to ensure that all information comes from reliable and trustworthy sources.
10. **Appendices**
    1. Everything that interrupts the flow of the report belongs in the appendices. Lengthy mathematical derivations, component mechanical drawings, detailed electrical and electronic circuits, listings of computer code, product specifications and data sheets, etc. are some of the items that typically are included in appendices.