

# Senior Design Project Policy

May 21, 2002

## Project checklist

The following is a list of the minimal required deliverables and their delivery dates:

|   |                              |                              |
|---|------------------------------|------------------------------|
| — | Problem statement            | Fall, 3rd week of quarter    |
| — | Design report                | Fall, 10th week of quarter   |
| — | Design review                | Winter, 3rd week of quarter  |
| — | Revised design report        | Winter, 4th week of quarter  |
| — | Operational System           | Winter, 10th week of quarter |
| — | Design conference            | Spring, 1st week of May      |
| — | Comprehensive project report | Spring, 10th week of quarter |
| — | Completed implementation     | Spring, 10th week of quarter |

## Spring quarter, junior year

The Senior Design Project is intended to be a capstone experience that draws on the previous three years of course work. As such, the project should be sufficient in scope and technical content to demonstrate students' technical competence developed during their careers at Santa Clara University.

Announcements are made at the beginning of the fourth week of classes regarding the design project for the following year. Students are responsible for finding a project advisor in time to register for COEN 194.

Students are encouraged to talk to faculty about potential topics for senior design projects well in advance of the registration deadline. These may be ideas that the students have, or projects suggested by faculty members. Interdisciplinary projects are encouraged; students should contact potential co-advisors early.

When agreement is reached about a project, students will be given permission to register for COEN 194 with the faculty member. It is highly recommended that the project be documented at this time with at least a brief vision statement that captures the stakeholders' understanding of the project.

We emphasize that the advisor's role is to advise, not just grade or sign documents. Students should consult regularly with their advisor, well in advance of deadlines, to get advice and feedback about the content and quality of deliverables.

## Fall quarter, senior year

### Conception Phase

- deliverable: problem statement (due last day of 3rd week)
- weighting: 20%

Students complete a problem statement, a document containing a description of the problem, the scenarios in which the problem occurs, and their solution to the problem. An emphasis is placed on the problem and its solution, not on the technologies that may be used to address the solution.

Key questions and issues the problem statement should address:

- Do the stakeholders (student(s), advisor, customers or users if any) agree on the purpose and scope of the project?
- Is there sufficient technical content in the project?
- Do the stakeholders have a vision of what the project solution or product will look like? Can they describe how someone would use the product?
- Do the stakeholders agree on the criteria defining a successful project?

The following example criteria would be appropriate for a software project:

Does the delivered project meet the following requirements for a Programming Product as described by Brooks[2]? Specifically:

- Is the product deployable on a variety of platforms, in addition to the one on which it was developed?
  - Is the product thoroughly tested, on a variety of platforms?
  - Does the project documentation include a set of test cases exploring the boundaries of functionality, that users and programmers can use to verify an installation or modification of the product?
  - Is the project documentation complete enough that a competent third party could install, use, maintain, and extend the product?
- Are these documented sufficiently so that an independent third party reader could evaluate the success of the final result?

**Assessment:** Grades for this component should be assigned according to how well the “key questions” are answered, as follows:

|                            |   |
|----------------------------|---|
| Definitely agree:          | 4 |
| Mostly <sup>a</sup> agree: | 3 |
| Somewhat agree:            | 2 |
| Little or no agreement:    | 1 |
| Missing:                   | 0 |

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<sup>a</sup>“Mostly” in this and similar contexts means “more than 80%.”

**Sample Document Contents:** Sample document contents are based on the deliverables suggested by Boehm[1].

1. Motivation
2. Background
3. Business Case
4. User Scenario(s)
5. Evaluation Criteria

### **Elaboration Phase, Part I**

- deliverable: design report (due last day of 10th week)
- weighting: 60%

Students work on requirements and design of project. Students should meet with their advisor frequently during the quarter for guidance. At the end of the quarter, the students deliver a design report, detailing the requirements and the high-level (architectural) design. At this point, the design should be complete; however, the students should be able to incorporate reviewer feedback from the design review in the winter.

Key questions and issues the design report should address:

- Are the functional requirements identified?
- Are the non-functional requirements (constraints) identified?
- Is there a feasible system architecture identified?
- Is there a rationale for the design?
- Are the above documented sufficiently so that an independent third party could understand them?

**Assessment:** Grades for this component should be assigned according to how well the “key questions” are answered, as follows:

|                                   |   |
|-----------------------------------|---|
| Definitely identified/documented: | 4 |
| Mostly identified/documented:     | 3 |
| Somewhat identified/documented:   | 2 |
| Not identified/documented:        | 1 |
| Missing:                          | 0 |

**Sample Document Contents:** Updated sections from Conception Phase, plus

1. Development timeline (plan)
2. Project Risks
3. Use Cases
4. Conceptual Model
5. List of Requirements (functional and non-functional)
6. System Sequence Diagram/Flow Chart
7. Architectural Diagram/Circuit Diagram/Hardware Block Diagram
8. Design Rationale
9. Technologies Used
10. Component State Chart(s)
11. Test Plan, including test cases
12. User Manual
13. Test or Experimental Results

### **Discretionary Component**

- deliverable: to be determined by advisor
- weighting: 20%

In each quarter, a discretionary component is included to allow advisors to require specific tasks or deliverables appropriate for the particular project.

## **Winter quarter, senior year**

### **Elaboration Phase, part II**

- deliverable: revised design report (due last day of 4th week)
- presentation: design review (3rd week)
- weighting: revised design report 20%, design review 20%

Students revise design report, incorporating advisor's (and reviewers') comments and adding low-level design details. If appropriate, low-level design details may be documented by a system prototype.

Key questions and issues the report and presentation should address:

- Is the vision of the product complete and stable?
- Has the architecture been defined and stabilized?
- Have all identified risks been eliminated or covered by a contingency plan?
- Do stakeholders agree on the likely success of the project?

**Assessment:** Grades for this component should be assigned according to how well the “key questions” are answered, as follows:

|   |   |
|---|---|
| Definitely complete/defined/addressed/agreed: | 4 |
| Mostly complete/defined/addressed/agreed:     | 3 |
| Somewhat complete/defined/addressed/agreed:   | 2 |
| Not complete/defined/addressed/agreed:        | 1 |
| Missing:                                      | 0 |

**Sample Document Contents:** Revised sections from Elaboration I Phase, plus

1. System Prototype
2. Collaboration Diagrams
3. Class Diagram or Schematic
4. Risk resolution/mitigation

## Construction Phase

- deliverable: operational system<sup>1</sup> (due last day of classes)
- weighting: 40%

Students begin implementation of the project and deliver the first version of the implementation, showing basic end-to-end functionality. Students should meet with their advisor frequently during the quarter for guidance.

Key questions and issues the implementation should address:

- Does the implementation show useful, end-to-end functionality?
- Are the features implemented of the highest importance?
- Is the implementation robust?
- Can a competent third party install, verify/test, and use the product?

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<sup>1</sup>For software projects, the operational system is a completely debugged, tested, documented, and deployed subset of the product features, which meets the criteria of a Programming Product described by Brooks[2]. The feature subset should be those of the highest importance to the function of the product, chosen in close consultation with the advisor. Hardware projects should deliver a product similar in nature, but tailored to the specific situation and approved by the advisor.

**Assessment:** Grades for this component should be assigned according to how well the “key questions” are answered, as follows:

|                                     |   |
|-------------------------------------|---|
| Definitely useful/important/robust: | 4 |
| Mostly useful/important/robust:     | 3 |
| Somewhat useful/important/robust:   | 2 |
| Not useful/important/robust:        | 1 |
| Missing:                            | 0 |

**Sample Document Contents:** Updated/revised sections from Elaboration II phase, plus

1. Source code or completed implementation
2. Build and install scripts, and/or instructions for installing/deploying hardware
3. Deployment instructions
4. Test cases, including input, expected output, and test implementation
5. Test results for features implemented

### **Discretionary Component**

- deliverable: to be determined by advisor
- weighting: 20%

In each quarter, a discretionary component is included to allow advisors to require specific tasks or deliverables appropriate for the particular project.

## **Spring quarter, senior year**

### **Delivery Phase**

- deliverable: comprehensive project report or senior thesis, completed implementation (last day of classes)
- presentation: design conference (first week of May)
- weighting: report/thesis 30%, implementation 30%, design conference presentation<sup>2</sup> 20%

Students complete implementation, document the system, and participate in the senior design conference. Students should meet with their advisor frequently during the quarter for guidance.

Key questions and issues the report/thesis, implementation, and presentation should answer:

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<sup>2</sup>Presentation score will be based on Advisor’s assessment, not Design Conference judge’s ratings.

- Could a similar team of competent engineers re-implement the product with only the documentation as guidance?
- Are the criteria for success defined in the conception phase satisfied?

Note: the thesis or report must be submitted in *both* hardcopy and PDF format to the advisor before it is considered delivered.

**Assessment:** Grades for this component should be assigned according to how well the “key questions” are answered, as follows:

|  |   |
|--|---|
| Definitely re-implementable/satisfied: | 4 |
| Mostly re-implementable/satisfied:     | 3 |
| Somewhat re-implementable/satisfied:   | 2 |
| Not re-implementable/satisfied:        | 1 |
| Missing:                               | 0 |

**Sample Document Contents:** Updated sections from Conception, Elaboration, and Construction Phases, plus

1. User Manual
2. API documentation
3. Maintenance Guide
4. Suggested Changes
5. Experiences/lessons learned
6. Complete test results

### **Discretionary Component**

- deliverable: to be determined by advisor
- weighting: 20%

In each quarter, a discretionary component is included to allow advisors to require specific tasks or deliverables appropriate for the particular project.

### **Grading guidelines**

A senior design course section should be treated as any other course section. Work is expected to be completed on time. Late deliverables will be assessed a penalty of 20% for each week, or fraction of a week, after the deadline.

The design project is considered a three course sequence and therefore failure of any one course section requires that the entire sequence be completed again.

- Plagiarism will not be tolerated. The first offense will result in a score of zero (0) on the offending deliverable. A second instance of plagiarism will result in a failing grade for the quarter.
- Only letter grades or an incomplete will be awarded; a grade of “N” is not allowed.
- If a student misses or is late for a Design Review or Design Conference presentation: automatic grade of zero (0) on that component.
- Failure of any course in sequence: student cannot graduate and must repeat entire sequence.

## References

- [1] Barry W. Boehm. Anchoring the software process. *IEEE Software*, 13(5):73–82, July 1996. <http://sunset.usc.edu/publications/TECHRPTS/1995/usccse95-507/ASP.html>.
- [2] Fred Brooks. *The Mythical Man Month: Essays on Software Engineering, Anniversary Edition*, chapter The Tar Pit, pages 3–9. Addison Wesley Longman, 1995.

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