

Advisor's guidelines for the senior thesis (Physics 195A/B)

Students using the senior thesis to fulfill their Disciplinary Communication requirement need a commitment from their research advisor to train them in academic writing and oral presentation. The department's expectations for the thesis -- and the advisor's role -- are described below. We are very grateful to those who take on this role for our majors, particularly faculty from outside the department and adjunct faculty.

Your duties as thesis advisor to a senior (in addition to research activities) are

- Helping them define the scope of their topic
- Helping them select, understand, and cite a substantial and appropriate set of references from the refereed literature
- Assigning deadlines for, and evaluating, the following assignments for **Physics 195A:**
 1. Thesis plan & outline
 2. At least two full drafts of the thesis Introduction, with significant revision from your comments
 3. Full bibliography (195A)
- Assigning deadlines for, and evaluating, the following assignments for **Physics 195B:**
 1. At least two full drafts of the full thesis, with significant revision from your comments
 2. An oral research presentation (with one rehearsal with you and feedback), typically of 12 minutes but possibly of more if desired, to any appropriate audience: in a group meeting, at a scientific conference, or in any venue provided by the department for this purpose (if the department hosts such an event, it will be announced ahead of time to all research group).
Sample syllabi for 195A and 195B are provided along with this document, and include suggested schedules.
- Setting an appropriate schedule for you to receive these items, for you to provide comments, for them to address your comments, and for you to read and approve the revisions
- Making sure the thesis is both correct and sufficiently substantial and **substantially meets the standards listed below**; and then making sure that the changes have been adequately addressed
- Promptly providing an electronic signature once you have decided that the thesis meets an appropriate standard and is complete

You are **not** required (or encouraged) to

- Suggest specific wording when pointing out a weak spot in the student's work
- Edit their writing at the proofreading level (although you should tell the student when they need to work on things like spelling and grammar in general and identify general issues)
- Rush your review of their work because the student has failed to give you adequate time
- Approve an inadequate draft because the graduation deadline is imminent (note that students who do not meet this deadline can still participate in the department's graduation and can take an incomplete in 195B).
- Badger the student about their schedule or feel responsible for whether they meet deadlines

Physics Senior Thesis Writing Standards

Students should think about these standards **before** writing, and advisers should consider them in evaluating first and final drafts.

General:

The thesis should be understandable by *other physics seniors* who are not working in this field; this will require more explanation in the introduction than would be normal for a journal article. But it should also reach a level of sophistication of the field of research that is beyond what is covered in undergraduate classes. The thesis does *not* have to reach a publishable result; a null result or incomplete project can still be the subject of a good thesis. The length is typically 20-30 pages excluding prefatory material and references and including a modest number of figures.

Writing style:

The writing style should be comparable to what is expected in a scientific journal, but students should be encouraged *not* to use unnecessarily elaborate vocabulary to appear more professional. It is important for the advisor to make sure the students understand what they are writing and are using their own words, particularly in the introduction. Flowery and vague language in the introduction and conclusion should be avoided. 195A/B are *writing* courses, so the advisor should be helping the student improve their writing style, including at the level of sentences, paragraphs, and sections, regardless of what level of proficiency they are starting from. But advisers should not be rewriting sentences for students; they should point out and describe weaknesses (specific and general) instead.

References:

References and citations should be fully up to the standards of a good journal article, being used to credit discoveries, and give examples of current similar work. There should be one or more citations for every statement of fact that is not general knowledge or original work. Wikipedia, news articles, and other non-primary sources should not be used, although arXiv preprints of original research are appropriate. Review articles should be used sparingly if at all. Although there is not a minimum required number of references, it should be unusual to need fewer than 15 references. References and citations should be in APA style -- citations in the text appearing as (Belanger et al. 2017) or "was shown by Belanger et al. (2017)", and references at the end being alphabetical by the last name of the first author, and containing authors, year, title, journal, volume, and page range.

Abstract:

There should be an abstract includes a concise and specific summary of all major conclusions and does not read like an introduction.

Introduction:

The introduction should begin with an overview of the goals of the work, so that the following background material has context from the start. Students and advisors should pay particular attention to making sure that everything is presented in an order that will carry the target audience (other physics seniors) along, explaining jargon as it comes up, and there should be careful attention to the referencing standards given above.

Sections reporting original research (methods, results, analysis, etc.):

While these sections are usually easiest to write, attention should be paid to logical and consistent use of tense (past vs. present), and be sure that it is written as a report of work done, not in the tone of

instructions or a lab manual.

Discussion / conclusion / summary:

A summary of results and conclusions should be included, and can bring in more contextual material with reference to other authors, related to the impact of the work on understanding of the field. An outline of possible future work is appropriate but not necessary.

Figures, Tables, and Equations:

As in standard journal practice, all Figures and Tables are numbered in order of their appearance, and must be referenced in the text in the order of their numbering. Figures should be clearly legible, and figures taken from other sources should have an attribution in the caption. Captions should fully explain what is seen in the figure, but interpretation should be left to the main text. Data in tables should show correct significant figures, indication of errors where appropriate, and use scientific notation when appropriate. Equations are numbered when they are referred to in the text, and every symbol used in equations should be defined in the text.

Appendices:

Appendices are an appropriate place to put technical details that are of potential interest but not necessary for the reader's understanding of the work and conclusions. They are not necessary and not often used. They should not include raw computer code or data tables exceeding 2 or 3 pages; web links are suitable for these materials if desired.

SAMPLE SYLLABUS FOR 195A

Course Title: PHYS 195A “Senior Thesis I”

Units: 5 units

Instructor: Prof. Jason Nielsen (jnielsen@ucsc.edu) [change to mentor as appropriate]

Meeting time and place: Monday, 8:00-9:05 AM, 315 Natural Sciences 2

Student hours: it is expected that students spend at least 1 hour per week with their mentor and at least 14 hours per week in independent research or writing activities.

Course description: Independent research for seniors conducted under the supervision of a faculty mentor. Students develop a written research proposal, thesis outline, and introductory thesis material.

Course learning outcomes: Upon completion of PHYS 195A, students should have demonstrated the ability to conduct independent research and to communicate their work orally and in writing. They will demonstrate this ability through a series of assignments/deliverables aimed on helping them complete the senior thesis by the end of PHYS 195B.

(These outcomes match one of our Program Learning Outcomes: “Students will communicate effectively, both orally and in writing, and will demonstrate that they can think critically and work independently while doing their senior thesis.”)

Evaluation/grading system: evaluations for the course will be based on the independent research progress and the written assignments.

- **Research work (50%):** research activities may include lab work, theoretical work, literature review, library research, project planning, and participation in research group meetings. Research evaluations take into account the care with which work is performed, the use of hypothesis formation and testing, and the use of scientific literature or background reading to understand the basis of the research topic.
- **Written presentations (50%)** of research work: presentations are graded on clarity, completeness, and organization with respect to the thesis or chapter guidelines.

Course schedule:

(It is assumed that the independent research activity continues each week throughout the quarter.)

Week number	Focus topic	Assignment/Deliverable
1	Thesis Goals and Topic	
2	Research Progress	1 page on Essential Question
3	Thesis Format / Overleaf	
4	Thesis Outline	Overleaf exercise
5	Research Progress	1 page Thesis Outline

6	Library Resources	
7	Research Progress	Reference List
8	LaTeX Typesetting	
9	Research Progress	5-page Thesis Introduction
10	Research Progress	
Finals Week	Final project	Revised 5-page Thesis Introduction

Academic integrity policies: each student is expected to uphold the academic integrity of the university (<https://registrar.ucsc.edu/navigator/section1/academic-integrity.html>). For this course, the most relevant concern is plagiarism, using someone else’s ideas or works without proper attribution or credit. Credit must be given when using direct quotations, paraphrasing someone’s ideas, or imparting information which is not common knowledge.

Accommodations for students with disabilities: UC Santa Cruz is committed to creating an academic environment that supports its diverse student body. If you are a student with a disability who requires accommodations to achieve equal access in this course, please submit your Accommodation Authorization Letter from the Disability Resource Center (DRC) to me privately during my office hours or by appointment, preferably within the first two weeks of the quarter. At this time, I would also like us to discuss ways we can ensure your full participation in the course. I encourage all students who may benefit from learning more about DRC services to contact DRC by phone at [831-459-2089](tel:831-459-2089) or by email at drc@ucsc.edu.

SAMPLE SYLLABUS FOR 195B

Course Title: PHYS 195B “Senior Thesis II”

Units: 5 units

Prerequisite: PHYS 195A

Instructor: Prof. Jason Nielsen (jnielsen@ucsc.edu) [change to research mentor]

Meeting time and place: Monday, 8:00-9:05 AM, 315 Natural Sciences 2

Student hours: it is expected that students will spend 1 hour per week with their mentor and at least 14 hours per week in independent research or writing activities.

Course description: Independent research for seniors conducted under the supervision of a faculty mentor. Students draft, revise, and submit a written senior thesis on their research topic.

Course learning outcomes: This course builds on the foundation built in PHYS 195A. Upon completion of PHYS 195B, students should have demonstrated the ability to conduct independent research and to communicate their work in writing. They will demonstrate this ability through the submission of the senior thesis by the end of PHYS 195B.

(These outcomes match one of our Program Learning Outcomes: “Students will communicate effectively, both orally and in writing, and will demonstrate that they can think critically and work independently while doing their senior thesis.”)

Evaluation/grading system: evaluations for the course will be based on the independent research progress and the written thesis submission.

- **Research work** (30%): research activities may include lab work, theoretical work, literature review, library research, project planning, and participation in research group meetings. Research evaluations take into account the care with which work is performed, the use of hypothesis formation and testing, and the use of scientific literature or background reading to understand the basis of the research.
- **Oral presentation** (20%): 12-minute (or longer) presentation of research results at a group meeting, departmental research symposium, or scientific conference. (This is the standard length of an American Physical Society meeting research talk.)
- **Senior thesis submission** (50%): final submissions are graded on clarity, completeness, and organization with respect to the thesis guidelines. Students cannot pass the course without submitting the senior thesis.

Course schedule:

It is assumed that the independent research activity continues each week throughout the quarter. The oral presentations will be scheduled for a department symposium held during week 5. Students should submit a full 25-page first draft of their senior thesis by the end of week 7 of the quarter. After working with their faculty mentor on revisions, they should submit the final version of the senior thesis by the Monday of Finals Week.

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