

## 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
- Reviewing their thesis plan, outline, introduction, and bibliography (195A) and full thesis drafts and oral presentations (195B) at appropriate times, and suggesting revisions
- 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
- Reviewing at least one full initial draft of their thesis and providing comments, making sure it is both correct and sufficiently substantial and **substantially meets the requirements on the checklist 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

### Senior Thesis Checklist

The student is requested to go through this checklist carefully before giving a complete draft to their advisor. The advisor is requested to think carefully about each item before checking it off.

General:

- \_\_\_\_\_ Student appears to understand what they are presenting at all times
- \_\_\_\_\_ Level of material is suitable (beyond what is presented in any undergraduate class, whether required or elective), and coverage is appropriately complete
- \_\_\_\_\_ Length of thesis: typically this is **20-30 pages** *excluding prefatory material and references*, and should not make use of excessive figures or images to reach this length, and is not stretched by unconventional formatting (see formatting requirements below). Partially blank pages (e.g. at the end of chapters) should be counted as only a suitable fraction of a page. While this length range is not a hard requirement, a thesis any shorter should be absolutely complete and well written. Please note the guidelines for a complete introduction below before determining that the thesis is really complete.

- \_\_\_\_\_ The thesis is structured into chapters and sections that follow a logical sequence and the material is organized and flows well for a new reader
- \_\_\_\_\_ The level of presentation is appropriate for *other physics seniors* who are not working in this field: routine undergraduate material is **not** explained in detail, "journalistic" metaphors for non-scientists are **not** used, and all terms and physics specific to the field and not known to most seniors **are** explained

#### References:

- \_\_\_\_\_ Although there is not a minimum required number of references, it should be unusual to need fewer than 15 references (see specifics below)
- \_\_\_\_\_ References include both foundational work in the field and cutting-edge, current work (including the work of competitors)
- \_\_\_\_\_ References are used systematically to give credit for first discoveries and important advances, and not just to report what the student happened to read
- \_\_\_\_\_ (Experimental theses only) Similar work by other authors is cited extensively, whether the student's laboratory work is making a scientific measurement, making material samples, or testing or calibrating instrumentation
- \_\_\_\_\_ (Experimental theses only) Even if the student's work is only on instrumentation or samples, there will be a significant number of references on the scientific applications of the material, instruments, or technique
- \_\_\_\_\_ At least 80% of references are refereed journal papers, or arXiv papers *if* unrefered arXiv papers are the standard in the field; and only a small fraction of these are review papers
- \_\_\_\_\_ Original (primary) references are used when at all possible instead of references to reviews, even refereed ones; a reference to any review should only be in the form of, "A good review of this area is given by ..."
- \_\_\_\_\_ No informal tutorials are cited (Wikipedia, someone's powerpoint on the web, other webpages, or tutorials uploaded to arXiv that are clearly meant as tutorials for students), unless as the source of a figure
- \_\_\_\_\_ No news articles are cited, unless as the source of a figure
- \_\_\_\_\_ The frequency of citation meets the standard of refereed journal articles, i.e. all claims are attributed to one or more references unless they are truly general knowledge or the result of original research
- \_\_\_\_\_ Citations are of consistent format and in APA style, e.g. (Belanger et al. 2017) or "was shown by Belanger et al. (2017)".
- \_\_\_\_\_ References contain all information required by APA style (authors, year, title, journal, volume, page range for journal articles)
- \_\_\_\_\_ The references are arranged in alphabetical order by the last name of the first author

#### Abstract:

- \_\_\_\_\_ The abstract includes a concise and specific summary of all major conclusions (including numerical values and errors when appropriate)
- \_\_\_\_\_ The abstract does not read like an introduction

#### Introduction:

- \_\_\_\_\_ The introduction begins with a section that informs the reader of the specific scope and purpose of the work, with just enough explanation for the reader to understand it (this gives the reader motivation and context for reading the full introduction)

\_\_\_\_\_ Both the first section of the introduction (overview) and the beginning of the real background material begin with substantial statements of fact that are informative to other physics seniors; they do not begin with broad, vague, or colorful language (e.g. "Gravitational waves have fascinated scientists since the dawn of time")

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

\_\_\_\_\_ These sections are reported in the past tense, except when describing the way that an experimental apparatus still in use is constructed or code that will be run again operates.

\_\_\_\_\_ The tone is as a report of what, specifically, was done, not the tone of a lab manual (i.e. it must not sound like instructions to another researcher)

Discussion / conclusion / summary:

\_\_\_\_\_ A discussion section is required that puts the work in a broader context, including the results of other workers and **specifics** of potential future work in the field

\_\_\_\_\_ As in the introduction, broad, flowery, vague, or enthusiastic language is avoided

\_\_\_\_\_ A brief summary of results separate from the discussion is recommended. It is similar in content to the abstract but different in style since it assumes that the full thesis has been read

Appendices:

\_\_\_\_\_ Appendices are well justified as appendices instead of main chapters, contain material that is of potential interest to the reader, and do not contribute to the page count

\_\_\_\_\_ Raw computer code should not be included as an appendix, but URLs giving access to code can be referenced in the thesis instead; the same goes for data tables exceeding 2 or 3 pages

Figures:

\_\_\_\_\_ All figures are original or adequately attributed in the caption and references

\_\_\_\_\_ If a figure is taken from copyrighted work, permission for use has been obtained according to the journal's policy or (if from a preprint) from the author

\_\_\_\_\_ All figures are numbered and referred to in the text, in order; they are referred to by figure numbers ("is shown in Figure 3") and not "is shown above" or "below" or "here:"

\_\_\_\_\_ Figures look good, do not invade margins, and all text is legible

\_\_\_\_\_ Captions are brief but complete in the sense of describing everything that appears on the figure; interpretation is left to the main text

\_\_\_\_\_ Figures are always referred to as figures and not "Graph 1", "Chart 1", etc.

Tables:

\_\_\_\_\_ Tables are legible and do not invade margins

\_\_\_\_\_ Tables have either full captions below, like figures (Physical Review convention) OR a short title above, with other needed information in footnotes (astronomy convention), and all tables use the same convention

\_\_\_\_\_ All tables are numbered and referred to in the text, in order, by table number

\_\_\_\_\_ Appropriate and consistent use of significant figures in all tabulated data

Equations:

\_\_\_\_\_ Equations that are referred to in the text are numbered and referred to by number

\_\_\_\_\_ Each equation is immediately followed by the definition of all symbols not previously identified

### Writing:

- \_\_\_\_\_ Text is divided into paragraphs of reasonable length and recognizable topic/purpose
- \_\_\_\_\_ The reader is at all times given what they need to understand what comes next (information is presented in logical order, even within paragraphs)
- \_\_\_\_\_ Neither the active nor passive voice is conspicuous by overuse
- \_\_\_\_\_ Tone is professional and adult
- \_\_\_\_\_ Sentences are varied in length appropriately (not conspicuous overall as short or long)
- \_\_\_\_\_ Writing and vocabulary are not complicated unnecessarily in order to sound exaggeratedly formal, technical, or sophisticated
- \_\_\_\_\_ Specific technical terms are introduced in the right time and the right way
- \_\_\_\_\_ Acronyms are spelled out the first time and then consistently appear as acronyms later
- \_\_\_\_\_ Grammar, spelling, and word choice are at a high level (advisor is not responsible for detailed proofreading and correction, but should point out general problems)

### Formatting

- \_\_\_\_\_ There is a cover page with the usual boilerplate ("...submitted in partial satisfaction..." etc.) followed by a page containing the abstract. Spaces for signatures are no longer required but students who want real signatures on their title page may still use these spaces
- \_\_\_\_\_ Double spaced; 11 point font size and a conventional font; 1" margins
- \_\_\_\_\_ Pages are numbered
- \_\_\_\_\_ There is a table of contents with (correct) page numbers following the abstract
- \_\_\_\_\_ Figures or tables and their captions are together and not separated by a page break
- \_\_\_\_\_ Each chapter and the References section begin on a fresh page