

396: Senior Projects

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1 Catalog Description

To be taken in two consecutive quarters. Independent basic or applied research project, conceived and performed under the direction of a department faculty member. Prerequisite: senior standing in materials science program.

2 Course Outcomes

3 396: Senior Projects

At the conclusion of the course students will be able to:

1. Understand the basis for making ethical decisions in the practice of science and engineering.
2. Formulate a research plan and workflow to address specific needs of a project. Document the plan, needs and constraints, and the engineering standards that will apply.
3. Execute the research plan, apply engineering standards, analyze results, and report on interim progress, both in oral reports and written documentation.
4. Write a review of the literature relevant to their research topic.
5. Give effective oral and written reports of ongoing and completed work to an audience of peers educated in materials science and engineering, but not specialists in the sub-topic.
6. Write a research report that analyzes the results and places them in the context of the field.

4 Writing a Literature Review

4.1 General Advice

A literature review is a critical evaluation of work published on a specific topic. Also known as a review paper, the purpose of this type of document is to provide an overview of the state-of-the-art in a given field. Reading a literature review on a topic related to your research project is a good way to learn about the subject quickly. It is an attempt to evaluate what work has been done, what results have been obtained, and what issues remain in a field.

Your literature review should summarize and analyze prior work, organized by topic, not author(s). You should indicate what was done, how it was done, what the results were and what the results mean. (What did the authors conclude?) Ultimately, it will serve as the basis for the Introduction section of your final thesis. The scope of the review should not be too broad; it should focus on the specific topics related to your work. On the other hand, the review might encompass several related topics, i.e. synthesis, characterization techniques, results of tests on materials similar to yours, details about specific materials properties that motivate this work, etc. Consider the related subjects you must understand to successfully understand and carry-out your work. Your discussion of prior work should logically motivate your project. Most importantly, the body of your review should not consist of sequential summaries of individual papers, by author – this makes for an unsynthesized “laundry list” that is difficult for most readers to follow. Your review should summarize what is known from the literature, organized topically, and conclude with what questions remain. You could also summarize the approach your project will take to address those issues.

As you read your sources, take note of the main concepts and variables related to your topic. (Really – take notes! Read with questions in mind: Why was this work done? What questions were the researchers trying to answer? Why? How? What was measured? Computed? What were the results? What conclusions could be made?) Different researchers might have used different techniques (experimental or computational) to address the same topic. Their results may or may not agree. Your job is to group related information from different sources and discuss it in a way that gives your reader an overview of the specific issues related to your research. It will be useful to start with an outline of main topics and subtopics, before you write complete sentences or paragraphs. This makes it easier to move information around, so you can more easily discuss work based on one topic at a time, not one paper at a time.

Structure your writing so that you start with general information and move to details. Your goal is to inform your readers. Your writing should follow a logical progression. Providing an overview before discussing details makes the document easier to read.

References in most peer-reviewed science or engineering journals are cited using a superscript Arabic numeral in the text. These are numbered in the sequence in which they appear, and are listed in the same order at the end of the paper. This is the method you should use. The citation style varies somewhat from journal to journal. One approach is to decide on the journal that would be most appropriate for submission of your work and use the guidelines provided to authors. One caveat – the Graduate School requires that graduate students include titles of journal articles in their citations, and this makes the list of references more useful to readers. You should do the same.

Finally, after you finish writing the first draft, set the document aside. Then return to it a day or two later and re-read it. Does it still make sense? Is it free from obvious grammatical and spelling errors? Is the wording concise and unambiguous? Would an educated reader unfamiliar with the details of your research still be able to appreciate the motivation behind it? Proofread.....revise.....proofread....submit only a carefully proofread report.

4.2 Checklist

Note: These are guidelines for content; please do not use “Introduction”, “Body” as subtitles in your review.

4.2.1 Title

Review of — what? Create a title that will define the scope of the review.

4.2.2 Body

Includes a discussion of prior work in the context of the general problem outlined. Topics are introduced with an overview, and then covered in sufficient depth. Results from different authors on the same topic are grouped and discussed/ analyzed in depth. (If your paragraphs begin with author names, consider how to re-organize the information.) Subtitles may be used to organize the document in a reader-friendly manner. Transitions from one section to the next should provide continuity and logical progression.

4.2.3 Conclusions

Information presented in the body is synthesized and summarized. Author provides insight into the problem. Thesis or topic for research clearly follows and is supported in the text.

4.2.4 References

Use appropriately, with superscript Arabic numerals in the text citing references listed at the end in numerical order. Use a reference manager like Endnote or Zotero.

4.2.5 Writing Mechanics

Writing is clear, precise and concise. Jargon is avoided. Important terms or concepts are defined, described, and used in context. Author uses parallel construction, complete sentences, proper verb tense, spelling & modifiers. Nouns and verbs agree in number. Nouns and verbs are in close proximity. Writing is neither redundant nor ambiguous. Word choice indicates clear thinking and precise meaning. White space is used well; pages are numbered.

4.3 Additional Information

Some excellent advice is available from Dena Taylor, Director, Health Sciences Writing Centre, and Margaret Procter, Coordinator, Writing Support, University of Toronto [?]. They distinguish between an annotated bibliography and a literature review (you are writing the latter). They provide questions which you can use to guide your reading of the literature as well as writing about it. The writing center at UW Madison also has some useful information describing the sequence of tasks related to writing a research paper [?].

4.4 Assessment Rubric

4.4.1 Title

Review should have a title that introduces the topic.

4.4.2 Introduction

Excellent: The thesis and scope of the problem are clearly introduced and groundwork is provided for the research effort.

Good: The research topic is introduced but the general context is missing, or the scope of the review is not well-enough defined.

Poor: Scope of the review is unclear.

4.4.3 Body

Excellent: Includes a discussion of prior work (including results) in the context of the general problem outlined, organized by topic (not by author or individual papers). Transitions from one section to the next provide continuity and logical progression. Topics are covered in sufficient depth.

Good: Some, but not all, sections follow in a logical order. Discussion needs more evaluation or analysis. Topics not covered in enough depth.

Poor: Subtopics appear disjointed. No evaluation of topics. Review presents sources serially (i.e. each paragraph cites a different author) without synthesis.

4.4.4 Conclusions

Excellent: Information presented in the body is synthesized and summarized. Author provides insight into the problem. Thesis or topic for research clearly follows and is supported in the text.

Good: Summary comments indicate some analysis, but overall thesis or research topic is not clearly defined based on preceding discussion.

Poor: No synthesis of information. No conclusions drawn.

4.4.5 Writing Mechanics

Excellent: Writing is clear, precise and concise. Author uses parallel construction, proper verb tense, spelling & modifiers. Writing is neither redundant nor ambiguous. Word choice indicates clear thinking and precise meaning. Grammar is correct. Spelling is correct. Pages are numbered.

Good: Generally clear, but sometimes repetitive, poor word choice or unnecessary words. Text is difficult to read. Subjects are too removed from verbs.

Poor: Construction is not parallel. Noun-verb agreement in number or meaning is poor. Verb tense is not consistent. Meaning is ambiguous, sentences are convoluted.

4.4.6 References

- Numbers in text refer to references at end, in numerical order.
- Placement of references is appropriate.
- An appropriate number of references are cited. Work is properly cited.
- Direct quotes are avoided
- Phrases are not “lifted” from reference texts (author uses own words)
- References are cited properly using a recognizable journal format.
- References are complete: titles, all authors, publisher, dates, page numbers, web titles/authors/ access dates, etc. are included.

References