

## **Senior Thesis and Undergraduate Research Policies/Procedures**

The Senior Thesis is an important part of a student's scientific training in the School of Geology & Geological Engineering. It sums and implements the knowledge gained in various classes and shared experiences in previous classes. A senior thesis also introduces students to a real-life scientific problem. Thesis preparation follows the typical lifespan of a research project and consists of three separate segments:

1. Development of the research proposal.
2. Execution of the research plan, with field and/or laboratory analyses.
3. Communication of results.

### **Courses Involved**

Students will progress through the following classes as they do research and complete their thesis: Geol 487 (Research I), Geol 488 (Research II), and Geol 494 (Senior Thesis). Some of the classes may be taken concurrently, depending on the type of research that is proposed. The full series typically requires two to three semesters to complete. Note, also Geol 356 (Geoscience Lectures), Geol 421 (Seminar I), and Geol 422 (Seminar II) should run concurrently with the research project.

Students should begin thinking early about their interests in a research project, certainly by their junior year. To stay on schedule, they must sign up for Geol 487 Research I in their third year of studies.

The first task for a student is to consider a research problem. This should go hand-in-hand with contacting potential thesis advisors and discussing ideas and approaches. Senior thesis advisors are usually faculty members of the School of Geology & Geological Engineering.

### **The Research Proposal**

Once a student has a topic and an advisor, they may sign up for Geol 487 (Research I) and submit a brief written description of the project to the advisor. To complete Research I, students must turn in a complete proposal by two weeks before the end of the semester. Typically, this will be 5-10 typewritten double-spaced pages. Figures, maps, tables, etc. do not count towards the number of pages.

The research proposal should have the following parts, as appropriate:

1. Title - brief and to the point
2. Introduction - What is the problem you will address or question you plan to answer? Why is it important? Why should others care? What are your multiple-working hypotheses.
3. Previous Research - What is the state of knowledge on this problem, both indirect and direct? Describe the work that others have carried out that bears directly on the problem you plan to address. Briefly summarize the gap in knowledge that you will explore.
4. Methods - Provide an overview of the methods you plan to employ, and then go into each step in detail. Provide a time line when will each part of the work you plan be completed? Are there contingency plans? What will happen if the methods do not work as well as you hoped)? How much will it cost and how will it be funded?

5. Anticipated Results - What are the probable results based on current understanding of the system? How will the results be presented (text, figures, tables, appendices, etc.)?
6. List of References - Make sure that all references cited in the text are included and none others. Pay strict attention to citation style. Use citation style of any high quality scientific journal such as Geology, Journal of Hydrology, Quaternary Research, Journal of Geophysical Research, etc., but be consistent.

Typically, the proposal will be read and returned for editing/modification several times before it is finalized and acceptable. Students will make an oral presentation of their proposal as part of Seminar I (Geol 421). They should provide their advisor with the scheduled date and time as early as possible, but no later than one week before the presentation. They should also practice their presentation with their advisor.

### **Rubric for Grading Thesis Presentation in Geology 421**

- Fail: No apparent logic or coherence in research plan, and/or the scope of research either too small or too large, and/or impossible to obtain the planned results, and/or missing literature review, and/or wrong formatting, and/or missing sections, and/or failure to improve the indicated shortcomings in writing or logic.
- Satisfactory: Otherwise excellent proposal but some gaps in logic, and/or incoherent style of research plan, and/or some sections missing critical information, and/or many factual errors or missing references, and/or some inconsistencies in formatting.
- Excellent: Clear scientific logic, plausible research plan of correct scope, coherent easy to follow writing style, all sections fully documented, and perfect formatting and references.

Students will summarize their research results and present them in Geol 488 (Research II).

### **Rubric for Grading Research II**

- Fail: No original research done, and/or substantial omissions or deviations from the research plan, and/or missing documentation of the results and analysis.
- Satisfactory: Otherwise excellent adherence to the research plan but with significant gaps, and/or failure to reach or fully document the results, and/or failure to adapt the plan in light of new findings.
- Excellent: Close adherence to the research plan, flexibility in adapting the project to emerging challenges, and conclusions reached and fully documented.

### **Geol 494 (Senior Thesis)**

No later than four weeks before the last day of classes, students must turn in a completed draft of their thesis. Note that much of it can be adapted from the original proposal. The final paper should be 8-15 pages long, consisting of the following sections, as appropriate:

1. Title - brief and to the point
2. Abstract - A 250 word or less abstract. Abstracts are NOT summaries. They are presentations of the key results.
3. Introduction - What is the problem you will address or question you plan to answer? Why is it important? Why should others care? What are your multiple-working hypotheses?

4. Previous Research - What is our current understanding of the problem being addressed? Describe the work that others have carried out that relates to the problem you addressed. Briefly summarize the gap in knowledge that you explored.
5. Methods - Provide an overview of the methods you used and then go into each step in detail. Provide sufficient detail to allow someone else to replicate your work.
6. Results - What answers did you find? How did the results address the question or hypothesis you presented? Present the results clearly and concisely using text, figures, tables, and appendices.
7. Discussion - How do your results relate to the work that others have done? Explain the answer to the question you posed.
8. Conclusions - Summarize your findings.
9. List of References - Make sure that all references cited in the text are included and none others. Pay strict attention to citation style; Use citation style of any high quality scientific journal such as Geology, Journal of Hydrology, Quaternary Research, Journal of Geophysical Research.

Typically, a thesis draft will be read by an advisor and returned for improvement one or more times. The final accepted copy of the Senior Thesis is to be provided in PDF format to the department. Students present thesis results in a Seminar II oral presentation.

#### **Rubric for Grading Senior Thesis**

- Fail: No apparent logic or coherence in thesis, and/or the scope of the thesis is either too small or too large, and/or missing results, and/or missing literature review, and/or wrong formatting, and/or missing sections, and/or failure to improve the indicated substantial shortcomings in writing or logic.
- Satisfactory: Otherwise excellent thesis but some gaps in logic, and/or incoherent style of the thesis, and/or some sections missing critical information, and/or many factual errors or missing references, and/or some inconsistencies in formatting.
- Excellent: Clear scientific logic, well executed and documented research project of correct scope, coherent easy to follow writing style, all sections fully documented, and perfect formatting and references.