

## Division of Analytical Sciences

### ANALYTICAL SCIENCES DOCTORAL REQUIREMENTS

The doctoral requirements include a series of courses, a thesis background exam, an independent research proposal, and the final Ph.D. thesis. All requirements except for the Ph.D. thesis itself (including all departmental requirements and the Graduate School minor requirement) are expected to be fulfilled by the end of the third academic year (Sept-May) of graduate study, and the Ph.D. thesis is expected to be completed by the end of the 6<sup>th</sup> year. Failure to meet these requirements on time will be considered unsatisfactory progress. Exceptions can be made in extenuating circumstances, but only with permission of the Analytical Division faculty.

#### **I. Coursework**

Each Ph.D. student in Analytical Sciences must receive credit in Chemistry 621 (including laboratory) unless specifically excused by the Division and approved by the major professor, based on written petition by the student. In addition, each student must receive credit for any two of the following courses: Chemistry 622, 623, 624, 625, 628, and 630 (Special Topics). Chemistry 630 "Special Topics" courses can be taken more than once for credit if they are on different subjects. Many of these courses will involve reading and critically evaluating the primary scientific literature.

#### **II. Thesis background oral (TBO) examination**

In the second year of study, all students will demonstrate that they have mastered the literature and obtained research skills needed to effectively conduct scientific research. The TBO involves a written proposal, oral presentation, and defense before a committee of faculty members. The TBO will typically evaluate the student in four key areas:

- 1) Knowledge of the scientific literature in the student's area of research
- 2) Ability to apply information learned in courses to research problems
- 3) Demonstrated progress to date in the student's Ph.D. thesis project
- 4) Demonstration of understanding of the scientific method through a coherent explanation of the objectives, goals, and proposed approach for the Ph.D. research yet to be completed.

Students must consult with their thesis adviser to determine the desired TBO topic.

- a) TBO Document:** A written document will be developed in preparation for the TBO. This document should be modeled after a standard NSF or NIH-style research proposal, including a summary of the relevant background literature, a clear statement of goals and objectives of the student's research, a discussion of research accomplished to date, and a proposal for work yet to be accomplished. A document detailing the proposal format is available from the Analytical Division Coordinator. In the written document, the student will develop the subject in detail. The research proposal should be distributed to the committee members at least seven days in advance of the seminar. It is the student's responsibility to ensure that all copying and distribution is done in a timely manner.
- b) The TBO seminar:** The TBO includes an oral presentation that will be presented publicly to all students and faculty. This may be done at the weekly analytical sciences seminar or at another time as determined by the Analytical Sciences faculty and Division Coordinator. The presentation should cover the background, progress to date and proposed research. Sufficient additional time (5-10 minutes) must be allowed for questions from the audience at the end of the seminar. Dates for each student's TBO will normally be assigned by the divisional faculty

and/or the Analytical Division Coordinator. Students are not permitted to change the date or time without permission of the division faculty.

- c) **The TBO Defense:** The research seminar will be defended before a committee of faculty members subsequent to the presentation. The student is responsible for scheduling the defense, which, if possible, should be done on the same day as the presentation. The committee will be selected jointly by the student and the thesis adviser and will consist of two faculty members in addition to the thesis adviser. The student's performance will be evaluated on: (1) the student's ability to demonstrate a thorough knowledge of those aspects of chemistry and instrumentation, both theoretical and experimental, which are needed to understand and carry out the research discussed in the seminar. (2) the ability to critically analyze the relevant literature, and (3) the ability to select and design experiments to address scientific questions of relevance to the research area.

Upon completion of the oral examination, the examining committee will decide on one of three options: 1) the student passes the examination, 2) the student receives a partial pass, or 3) the student fails the examination. A "partial pass" will be given when there are some deficiencies that must be corrected before the student can be allowed to continue toward a Ph.D. A partial pass will require additional effort on the student's part to correct the deficiencies; corrective measures will be determined individually by the TBO committee. Typical remedies may involve rewriting or adding material to the document, having a second individual discussion with the faculty, and/or doing a second presentation and defense. If a student fails the examination outright, the student will not be permitted to continue toward the Ph.D. degree.

### **III. Original Research Proposal**

All students will present an independent research proposal. The "RP" is intended to meet the breadth requirement and must be on a topic of the student's choosing that is substantially different from the student's own thesis area. It is intended to evaluate the student's ability to learn a new area of science on an independent basis, to identify important scientific questions and form testable hypotheses, and to propose experimental or theoretical approaches to answering the questions and testing the hypotheses. The RP is similar in format to the TBO, consisting of a 8-10 page written research proposal, public presentation, and closed-door exam. Scheduling of the RP is normally done on an individual basis, but must be completed by the end of the third year unless special permission is granted.

Upon completion of the oral examination, the examining committee will decide on one of three options: 1) the student passes the examination, 2) the student receives a partial pass, or 3) the student fails the examination. A "partial pass" will be given when there are some deficiencies that must be corrected before the student can be allowed to continue toward a Ph.D. A partial pass will require additional effort on the student's part to correct the deficiencies; corrective measures will be determined individually by the TBO committee. Typical remedies may involve rewriting or adding material to the document, having a second individual discussion with the faculty, and/or doing a second presentation and defense. If a student fails the examination outright, the student will not be permitted to continue toward the Ph.D. degree.

### **IV. Obtaining Dissertator Status**

When requirements I, II, and III have been met, complete a *Request for Preliminary Warrant*. Obtain this form at the Graduate Admissions Office, Room 2108.

*Effective: Spring 2007*

## Alignment of Materials and Analytical PhD programs with guidelines for “Degree of Uniformity”

Departmental Uniform Requirements	Analytical	Materials
<p><b>Domain Knowledge</b> (includes coursework, minor completion, or topic exams)</p>	<p><b>Coursework:</b> 621; credit for two out of 622, 623, 624, 625, 628, 630; Chemistry 901; Chemistry 920 (Analytical seminar attendance); Chemistry 993 (Research) <b>Other:</b> minor completion, defined by Graduate school</p>	<p><b>Coursework:</b> Credit for 3 grad-level courses in materials (Chemistry 630-Hamers, Chemistry 842-McMahon, or by approval of Materials Chair); Chemistry 901; Chemistry 920 (Materials seminar attendance); Chemistry 996 (Research) <b>Other:</b> minor completion, defined by Graduate School</p>
<p><b>Thesis Background Presentation</b> (must include a written and oral component)</p>	<p>Thesis research proposal:</p> <ol style="list-style-type: none"> <li>a. written proposal and progress report</li> <li>b. 30-minute seminar</li> <li>c. committee defense/examination (committee: minimum 2 faculty + advisor)</li> </ol> <p>Normally completed by the end of the 2<sup>nd</sup> year</p>	
<p><b>Literature Evaluation</b></p>	<p>The literature evaluation requirement will be met by including the careful reading and analysis of current research papers in the divisional graduate courses &amp; through preparation of the two RPs.</p>	
<p><b>Original Research Proposal</b> (should be in an area not closely related to student’s research)</p>	<p>Independent research proposal:</p> <ol style="list-style-type: none"> <li>a. NSF style proposal outside thesis area</li> <li>b. Approved by adviser</li> <li>c. Includes seminar and defense</li> <li>d. committee defense/examination (committee: minimum 2 faculty + advisor)</li> <li>e. To be completed within 3<sup>rd</sup> year.</li> </ol> <p>File <b>Request for Preliminary Warrant</b> 3 weeks prior to proposal presentation.</p>	
<p>First four stages completed (dissertator status) by end of 6<sup>th</sup> semester (3rd year)</p>	<p>Dissertator by end of the 6<sup>h</sup> semester (end of the 3<sup>rd</sup> year)</p>	
<p><b>Thesis Planning Meeting</b> (specifically for students who haven’t set a date for defense by the end of the 5<sup>th</sup> year)</p>	<p>Thesis planning meeting (specifically for students who haven’t set a date for defense by the end of the 5<sup>th</sup> year)</p>	
<p><b>PhD Thesis</b> (document and defense usually completed before the end of the 6<sup>th</sup> year)</p>	<p>PhD Thesis (document and defense usually completed before the end of the 6<sup>th</sup> year)</p>	