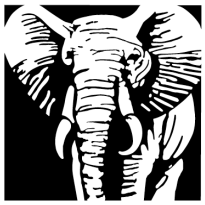

CAL STATE FULLERTON

GRADUATE HANDBOOK

FOR THE

MASTER OF SCIENCE DEGREE

IN CHEMISTRY

Department of Chemistry and Biochemistry

California State University, Fullerton

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I. MASTER OF SCIENCE IN CHEMISTRY - DEGREE PROGRAM

The Master of Science (MS) degree in chemistry is designed to qualify students for advanced work in chemistry and biochemistry. The MS degree will lead to positions in industrial, government, or academic laboratories, preparation for entry into and completion of a chemistry or biochemistry Ph.D. degree, or effective chemistry teaching in high schools and community colleges.

The program provides fundamental courses at a level and depth commensurate with those taken during the first year of a doctoral program. It additionally provides training in modern chemical or biochemical research and research methods. Six concentrations in the degree are available: analytical, biochemistry, chemical education, inorganic, organic, and physical.

The program has been designed to allow completion of the degree coursework in two years, including summers (see timeline below). However, part-time participation or the need to take refresher courses will extend that time. Completing the MS thesis research project can extend beyond two years based on student effort and degree of research success; MS students are encouraged to regularly consult with their research advisor about their progress in research.

The formal steps in obtaining the MS in Chemistry are:

A. Admission (granted for either Fall or Spring)
B. Classification (completion of any pre-classification requirements)
C. Advancement to candidacy (after a request is filed for graduation)
D. Graduation (completion of requirements and awarding of degree).

Requirements and procedures for admission to the graduate programs at CSUF are given in the University Catalog. Additional steps and requirements for admission to the graduate program in this department are described on the department website.

The MS program requires 30 units of coursework for completion of the MS in Chemistry. These are divided into core and elective classes and research and thesis courses. More details about this coursework are given below.

II. ADVISEMENT

Graduate students will meet with the graduate program advisor each semester while completing their 30 units of coursework. The graduate program advisor's role is to provide guidance on completing the coursework along with, as needed, general mentorship.

Once a student joins a research group, they should also obtain advisement from their research advisor. The research advisor should be a MS student's primary research mentor and provide discipline-specific guidance regarding career goals.

III. PRE-CLASSIFICATION REQUIREMENTS

A student's foundational knowledge of chemistry or biochemistry is essential for completing the MS program. A new graduate student must demonstrate their mastery of chemistry or biochemistry at the undergraduate level. Completing all upper-division undergraduate chemistry or biochemistry major courses with an average GPA of 3.0 or higher and earning an average grade of B or better in courses related to their graduate field of study will demonstrate mastery of chemistry or biochemistry fundamentals.

Students who have not earned an average GPA of 3.0 or higher in all upper-division undergraduate chemistry or biochemistry major courses and/or have not earned an average grade of B or better in courses related to their graduate field of study will establish their mastery by completing one of the following:

1) Passing 1 placement exam in their intended area of graduate study (analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, or physical chemistry) before starting their 1st semester in the graduate program. Scoring at the 40th percentile or higher on the exam is considered passing.

2) Taking an undergraduate course during their 1st semester in the program and earning a grade of B or better. The specific course required will be determined by the Graduate Program Advisor based on the student's intended area of graduate study.

Students that do not meet either of these requirements at the end of their 1st semester in the program will be removed from the graduate program.

IV. SELECTION OF A RESEARCH ADVISOR

A graduate student should select a research advisor during their 1st semester in the program. Graduate students typically meet with several faculty to discuss their research and expectations for graduate students. Students are encouraged to begin meeting with faculty after receiving admission into the program.

Once a student joins a research group, the faculty research advisor and the student will work together to fill out the Department of Chemistry and Biochemistry Graduate Mentor-Mentee Agreement. A copy of this agreement is appended to this handbook. In doing so, it is important that both parties clearly communicate their expectations for each other. Copies of the signed Mentor-Mentee Agreement should be kept by the faculty advisor and student. A copy of the agreement shall also be given to the graduate program advisor. If a student's faculty research advisor is also the graduate program advisor, then a copy of the Mentor-Mentee Agreement will be given to the department chair.

Both the faculty research advisor and the student have the option to request a revision to their Mentor-Mentee Agreement. In this case, both parties need to discuss their expectations for each other, sign a revised copy of the agreement, and send a revised copy to graduate program advisor or department chair.

It is our hope that every mentor-mentee relationship is successful! The Department of Chemistry and Biochemistry Graduate Mentor-Mentee Agreement describes the procedure that will be followed if either party feels that the other is not meeting their expectations.

The Department of Chemistry and Biochemistry Graduate Mentor-Mentee Agreement shall be optional for students with expected graduation dates in Fall 2024, Spring 2025, and Summer 2025.

V. COURSEWORK

The degree program consists of 30 units of coursework approved by the faculty research advisor and graduate program advisor. Generally, at least 27 of these units are 500-level. With the approval of the faculty research advisor and graduate program advisor, a MS student may take up to 6 units of 400-level coursework. Courses below 400-level, courses taken to demonstrate competency, CHEM 423A, CHEM 423B, and CHEM 422 do not count towards the MS degree.

An overview of the 30 units of coursework, along with a suggested plan for completing it, is given below. Note that the faculty research advisor has final approval on graduate student enrollment in the research courses Chem 598 and Chem 599.

Course	Units
Chem 500 (Introduction to Graduate Studies)	2
Chem 505A (Seminar Participation) 2 Semesters (1 unit/semester)	2
Chem 505A (Seminar Participation) 1 Additional Semester OR Chem 560 (Teaching Effectiveness in Chemistry Labs)	1
Chem 505B (Seminar)	1
Chem 599 (Independent Graduate Research)	6
Chem 598 (Thesis)	6
Chem 5## (Concentration Coursework)	6
Chem 5## or Chem 4## (Concentration Coursework)	3
Chem 5## or Chem 4## (Elective Coursework)	3
Total Units	30

Year 1		Year 2		Already Completed 30 Units
Fall	**Spring**	**Fall**	**Spring**	Students that have earned 30 graduate units, but have **not** completed their thesis will enroll in GRAD700 ($400)
Chem500(2)	Chem505A(1)	Chem505A(1)	Chem505B(1)	
Chem505A(1)	Chem5##(3)	Chem5##(3)	Chem599(2)	
Chem5##(3)	Chem599(2)	Chem599(2)	Chem598(3)	
		Chem598(3)		
		Chem4##(3)		
6 UNITS	6 UNITS	12 UNITS	6 UNITS	
Graduate tuition and fees for California residents: 0-6 units: $2,902.81 or 7 or more units: $4,498.81				

GRAD 700 allows students to remain enrolled at a reduced tuition (approximately $400). GRAD 700 students may be hired as teaching and/or research assistants. Note that GRAD 700 students may choose to pay additional fees to obtain access to CSUF healthcare (including counseling and psychological services) and CSUF recreation facilities; these services are not included in the reduced tuition.

For international students, some visas require that the student enrolls full-time at 9 units/semester. A student can be considered full-time at 6 units/semester if they are employed as a teaching assistant or graduate assistant. The student must complete a form requesting a reduced course load from the International Studies Office.

Six of the thirty units are core courses all graduate students in the program take. **Chem 500 (Introduction to Graduate Studies)** is a 2-unit course taught in the fall that introduces students to the MS Chemistry program and the resources available to them at CSUF. The 1-unit seminar courses **Chem 505A (Seminar Participation)** and **Chem 505B (Seminar)** are taught each semester. These two courses provide graduate students with practical skills on how to deliver an oral presentation by focusing on organizing, evaluating, and presenting scientific information professionally. They culminate in a departmental seminar consisting of a 40-minute presentation with 10 minutes for questions; each student presents this seminar to the department in **Chem 505B**. All graduate students will take 2 units of **Chem 505A** and 1 unit of **Chem 505B**. Graduate students can choose to take a third unit of **Chem 505A** or take 1 unit of **Chem 560 (Teaching Effectiveness in Chemistry Labs)**. **Chem 560** is taught each fall and introduces effective teaching strategies. **Chem 560** is especially recommended for graduate students who are serving or plan to serve as departmental teaching assistants.

Each student must take six units of 500-level coursework and an additional three units of 400-level or 500-level coursework in their concentration. The following are suggested core courses for each concentration. An alternative set of courses can be developed to meet an

individual student's needs. This requires the approval of both the faculty research advisor and the graduate program advisor.

Analytical:
- Chem 511 - Advanced Analytical Chemistry
- Chem 512 - Advanced Instrumentation
- Chem 552 - Kinetics and Spectroscopy

Biochemistry (at least 3 of the following)
- Chem 541 - Protein Biochemistry
- Chem 542 - Nucleic Acid Chemistry
- Chem 543 - Physical Biochemistry
- Chem 546 - Metabolism and Catalysis

Inorganic (at least 3 of the following)
- Chem 480T – Materials Chemistry
- Chem 425 - Advanced Inorganic Chemistry
- Chem 551 - Quantum Chemistry
- Chem 552 - Kinetics and Spectroscopy

Organic
- Chem 531 - Organic Reaction and Mechanisms
- Chem 535 - Organic Synthesis
- Chem 537 - Organic Spectroscopy

Physical
- Chem 512 - Advanced Instrumentation
- Chem 551 - Quantum Chemistry
- Chem 552 - Kinetics and Spectroscopy

Chemical education graduate students are encouraged to consult with their faculty research advisor and graduate program advisor to develop a series of appropriate courses to take. Such courses may include Chem 562 (Review of Research Methods in Discipline-Based Science Education). Chemical education students should take Chem 560 in place of one unit of Chem 505A.

In addition to the minimum nine units of concentration courses, each student must take an additional three units of 400- or 500-level coursework. In some cases, courses from other departments are appropriate and can be approved by the graduate program advisor.

Unless special permission is granted by the graduate program advisor, only three units of Chem 580T or Chem 480T (Special Topics courses) may be credited towards fulfillment of the course requirement.

It is important to note that, per UPS-411.100, any 400-level course taken to fulfill the MS degree must require graduate students to complete additional work above and beyond that required of undergraduate students.

The remaining 12 units are associated with the MS thesis project: **Chem 599 (Independent Graduate Research)** and **Chem 598 (Thesis)**. These should be scheduled based on the schedule given above with input from the research advisor. The research advisor has the final say on when these courses will be taken.
Up to nine units of courses taken during a student's undergraduate studies can count towards the MS degree, provided each course satisfies the following criteria:

a) Coursework applied to the MS degree cannot have been used to fulfill any baccalaureate degree requirements (including major, minor, or concentration).
b) The coursework must have been completed at an accredited college or university.
c) Coursework applied to the MS degree must have been taken within five years of entering the Master's program.
d) The student must have earned a grade of "B" or better in any coursework taken as an undergraduate that will be applied to the MS degree.
e) The student must provide evidence that the course is comparable to a 400- or 500-level course at CSUF (excluding the undergraduate biochemistry courses Chem 421, Chem 423A, Chem 423B, and Chem 422).

A student wishing to transfer undergraduate coursework to the MS degree must consult with the graduate program advisor about the suitability of the potential transfer courses. The graduate program advisor has the final authority to decide whether an undergraduate course is suitable for transfer into the MS degree. If the graduate program advisor approves the transfer, the student must submit a petition form; this form is available on the Registration and Records website.

Graduate students must complete all 500 and 400-level courses, excluding Chem 598 and Chem 599, with a cumulative grade point average of B or better. Additionally, only grades of C or better are acceptable for the 30 units that count towards the MS degree. If a student earns a grade of C- or lower in a course, then the student must either retake the course or take an additional 400- or 500-level course.

A graduate student is placed on academic probation if the MS grade point average (excluding Chem 598 and Chem 599) falls below 3.0. Graduate students will be allowed two semesters on academic probation before being subject to disqualification. A student placed on academic probation will receive a letter from the Graduate Studies office detailing what needs to be done to maintain their graduate student status. The Graduate Studies Office maintains a list of students on probation and subject to disqualification (see the University Catalog for more details).

VI. THESIS

A. Introduction

A *thesis* is defined as the written product of a systematic study of a significant problem. It identifies the problem, states the major assumptions, explains the significance of the undertaking, sets forth the sources for and methods of gathering information, analyzes the data, and offers a conclusion or recommendation. The department requires, therefore, that the

thesis be an original contribution in chemistry or biochemistry and contain material that could merit publication in the scientific literature.

B. Thesis Committee

A thesis is defended to and approved by the thesis committee. University policy states that this committee should include not fewer than three faculty members, one of whom is the student's research advisor, plus two other faculty members, at least one of whom is from the department. Under certain circumstances, this committee may include more than three faculty members. The committee is chosen by the student in consultation with the research advisor and must be approved by the graduate program advisor.

The graduate student should establish their thesis committee at least 1 year before the semester in which they intend to defend.

C. Preparation and Approval

The thesis should be completed in close cooperation with the research advisor. In addition, the thesis must be approved by the graduate student's thesis committee.

The Graduate Studies Office sets the general style for theses. A research thesis will go more smoothly if the writing is started while the research is in progress. A template and guidelines for writing and submitting a thesis are available from the Graduate office website: http://www.fullerton.edu/graduate/academics/thesis.php
It is not the responsibility of the Graduate Studies Office to proofread a thesis. Proofreading is primarily the responsibility of the graduate student and the research advisor. The thesis should be free of known errors when submitted to the Graduate Office.

D. Content
The research thesis describes original work carried out by the student under the supervision of the research advisor. The research advisor should be consulted frequently during the preparation to avoid extensive rewriting later. The graduate student will complete six units of Chem 599 and six units of Chem 598 as they complete their research and write a thesis.

The M.S. Chemistry thesis consists of the following components:

1) Introduction Chapter
2) Methods Chapter
3) Research Chapter(s)
4) Conclusions Chapter

For the introduction and methods Chapters, the research advisor and graduate student shall collaboratively decide upon one of the two options summarized below:

Option 1:

Introduction Chapter: The introduction chapter should provide background and context to the thesis research based on an exhaustive literature search that establishes that the student has developed a general expertise of their field. This generally is more comprehensive than the standard introduction section of a research paper. The introduction chapter must clearly identify at least one research question/hypothesis that the thesis will then seek to answer/test.

Methods Chapter: The methods section of the thesis should concisely describe the experimental or computational methods used to conduct the research with enough detail to allow for replication of the student's research. The level of detail should be appropriate for a publication in the student's field.

Option 2:

Introduction Chapter: The introduction chapter of the thesis should provide background and context that motivates at least one stated research question/hypothesis that the thesis will then seek to answer/test. This introduction chapter should be comparable in scope to what is typical in a publication in the student's field and should demonstrate that the student has expertise in the background underlying their research topic.

Methods Chapter: The methods chapter should describe the experimental or computational methods used to conduct the thesis research. The methods chapter should be more exhaustive than what is included in a research paper. As appropriate for their field, the faculty research advisor may require the MS student to describe how the methods work and why they are appropriate for the research project. Safety procedures should be described if a method used in the thesis has special hazards.

The thesis committee shall respect the decision made by the research advisor and graduate student as to which option is chosen. In particular, the thesis committee should not require significant expansions to the methods chapter for Option 1 or the introduction chapter for Option 2.

Regardless of which option is chosen, the remaining chapters of the thesis have the following form:

Research Chapter(s): The research chapter(s) describe the results obtained by the MS student using the methods described in the methods chapter and discuss their scientific meaning and implications in relation to the research question(s) posed by the thesis. It is expected that the MS student made a significant contribution to the research included in the thesis.

In general, the total work described in the research chapter(s) should be similar in scope to the work required for a single first-author paper within the student's field. In the case that a student made significant contributions to multiple projects, it is appropriate for each to be a

research chapter. The final decision on the appropriate scope of work for the thesis lies with the research advisor.

If the MS student is a co-author and provided significant work on a published or accepted, peer-reviewed research paper, then this paper can be added to the thesis as one of the research chapters. Any supporting information for the paper must be either added to the research chapter or included as an appendix. Generally, the text of a peer-reviewed research paper can be added to the thesis without significant revisions. However, the following revisions may be required:

a) The faculty research advisor may require revisions to the published research paper if the student is not a primary author. In determining the scope of these revisions, the faculty research advisor will consider factors such as the degree to which the student contributed to the published research paper and the impact of this research chapter on the thesis as a whole.
b) The faculty research advisor may require the incorporation of additional information in the thesis that was not included in the published or accepted research paper.
c) The faculty research advisor and/or thesis committee may require edits to the introduction and conclusion sections of the published or accepted paper to reduce redundancy and improve cohesion with the rest of the thesis.

If applicable, it is the student's responsibility to obtain copyright permission from the journal(s).

Conclusions Chapter: The conclusion chapter reiterates the purpose of the thesis and provides a concise summary of the results presented in the thesis that demonstrates the purpose was achieved. If appropriate, the student may discuss future work.

E. Timeline for Preparing for Thesis Defense

This timeline is based on the thesis submission deadline for the semester in which the graduate student plans to submit their thesis. The timeline represents the deadlines by which each activity must be completed. The student and their research advisor can choose to accomplish these objectives earlier. A student who fails to meet one or more of these deadlines may have to postpone their defense to one semester later than their original plan. If a thesis defense is postponed (either electively or based on failing to meet deadlines), then any completed items in the timeline do not need to be redone.

1 Year Before Thesis Submission Target: The graduate student must form a thesis committee that is approved by the graduate program advisor and research advisor. All members of the committee must have agreed to serve on the committee.

6 Months Before Thesis Submission Target: The graduate student will email an outline of their introduction, methods, and research chapters to their thesis committee. The research advisor must approve the outline, and it must be sufficiently detailed to allow the thesis committee members to recognize the structure and big-picture content of the thesis. The research chapter(s) outline should include any planned work that has not yet been accomplished.

The thesis committee members are encouraged to meet briefly with the student to discuss the outline. The purpose of these meetings is to initiate conversation between the graduate student and the thesis committee members as well as encourage the MS student to begin thinking about their thesis well before the defense. At these informal meetings, the committee members will provide big-picture suggestions for the thesis. The thesis committee members are not expected to provide detailed feedback on any aspects of the thesis at this stage. If a committee member feels that the outline is acceptable and has no significant feedback to provide, they can email the student instead of meeting.

2 Weeks Before Thesis Defense: The graduate student must distribute a complete thesis draft to the committee. This complete draft shall be fully approved by the research advisor and free of known errors.

Thesis Defense: It is advised to schedule the thesis defense at least two weeks before the thesis submission deadline to ensure that there is sufficient time to complete all required edits by the deadline. The thesis submission deadlines can be found here: http://www.fullerton.edu/graduate/academics/thesis.php

F. Oral Defense of Thesis

A thesis must be defended before the thesis committee (Section V). The student shall submit the thesis to the committee members at least two weeks before the scheduled date of the thesis defense. By submitting the thesis to the committee members, the faculty advisor guarantees that the thesis is ready to be defended and printed. The defense shall take part according to University and Departmental guidelines:

- An oral defense typically includes a presentation by the Master's candidate to the public and the student's thesis committee. The presentation will be composed of the student's major research accomplishments and results, with a discussion about what the results mean. After the public presentation, the graduate student and thesis committee will have a private meeting to discuss the thesis presentation and ask questions to gauge the student's understanding of their research.

- The defense will be held in an appropriate academic environment, generally on campus. Program faculty may approve oral defenses undertaken partly or wholly in mediated environments, including via conference call or online, provided the defense takes place in "real-time."

- The oral defense, usually a graded pass/fail event, is documented by the student and thesis committee completing the thesis verification form. Members may, however, withhold their approval until necessary changes are made to the thesis.

VII. ADVANCEMENT TO CANDIDACY AND GRADUATION

A. Advancement to Candidacy

Advancement to candidacy is achieved upon completion of a successful graduation check. The student must file an application for a graduate check and pay the graduation fee before the final graduation term.

B. Graduation

To be eligible for graduation, a student must:

1) Apply for graduation through their student portal.

2) Conform to and complete all department and university regulations regarding graduation, which include:

- Completion of all graduate coursework with a grade point average of 3.0 or better in all courses exclusive of Chem 598 and 599. Additionally, a grade of C or better must be earned on each course that contributes to the 30 units of the MS degree.

- Presentation of a departmental seminar (completion of Chem505B).

- Completion and oral defense of the thesis (Section VI. A-F) and its approval by the thesis committee and the Graduate Studies Office.

3. The procedure for final approval of the thesis is described on the CSUF graduate studies website http://www.fullerton.edu/graduate/current_students/thesis.php.

4. At the beginning of the graduation term, in which the thesis completion is expected, the student and the research advisor should prepare a calendar that includes dates for completing the steps listed below.

- Rough draft of the thesis to research advisor. The research advisor should be consulted frequently during the preparation to avoid extensive rewriting later.

- Public oral defense of the thesis before the thesis committee. This date should be at least two weeks after the committee receives a final copy of the thesis. This meeting is the formal time for approval of thesis content, and at its conclusion, the thesis committee signs the thesis verification form. Members may, however, withhold their approval until necessary changes are made to the thesis. In addition, the committee may require the graduate student to complete a second oral presentation if the first attempt is deemed unsatisfactory.

- Submit the thesis to the Graduate Studies Office. The University thesis reader will review the committee-approved thesis. The thesis reader may contact the student to make formatting changes to meet University standards. Once the thesis reader has approved the thesis, it will be

published, and the student can order additional copies of the thesis. Please refer to the office of graduate studies website for more information.

VIII. GRADUATE STUDENT ASSISTANTSHIPS

The department may hire graduate students to serve as graduate and teaching assistants. Hiring depends on departmental needs and student qualifications. Renewal of a teaching assistantship requires satisfactory fulfillment of teaching responsibilities, which may include the results of the required student opinion questionnaire administered in each class each semester, class observations, and input from lecture instructors and laboratory coordinators.

IX. CONTINUOUS ENROLLMENT

A graduate student must maintain continuous enrollment during regular semesters until award of the degree. This policy is designed to eliminate the need for re-admission to the university, to provide the opportunity for continuous use of facilities, including the library, and to assure the development of an integrated program, adequately supervised and effectively terminated within the time limitations allowed by regulations. Once a student has completed the required 30 units for the degree, the student may register for Graduate Studies 700 (GRAD700). Generally, students should only enroll in GRAD700 for up to two semesters.

A student may apply for a leave of absence for up to one year. The following are situations for which a leave of absence could be requested:

a) Illness, disability, or similar personal exigencies (including pregnancy)
b) Activities that enhance a student's professional career objectives
c) Active duty in the armed forces of the United States
d) Severe financial hardship

A student interested in applying for a leave of absence should discuss their options with the graduate program advisor.

Unless granted an approved leave of absence, a graduate student who fails to register each semester will be discontinued from the graduate degree program. If the student wishes to resume studies, it will be necessary to reapply for admission to the university and to the degree program and meet any changes or additional requirements approved in the interim. A leave of absence will only be considered for the circumstances described in the University Catalog.

X. TIME LIMIT FOR COMPLETION OF THE MASTER'S DEGREE

All requirements for the Master's degree, including all course work and defense of the thesis, must be completed within five years, beginning the first semester of graduate status. See the University Catalog for further information on this subject.