

HANDBOOK FOR GRADUATE STUDENTS
Department of Chemistry and Biochemistry, Texas Tech University

(Revised August 2015)

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All forms referenced in this Handbook can be downloaded from the department’s website:

Chem.ttu.edu under the “Current Graduate Students” link

I. INTRODUCTION AND OVERVIEW

Welcome to the Graduate Program in the Department of Chemistry and Biochemistry at Texas Tech University! The purpose of this Handbook is to give you a description of the departmental requirements for earning an advanced degree in chemistry. General requirements for graduate degrees are given in the Catalog of the Graduate School for the current year; those requirements govern advanced degree study at all times. The requirements presented in this Handbook are intended to amplify and supplement those stated by the Graduate School, particularly as they pertain to the Department of Chemistry and Biochemistry. Keep in mind that *you are subject to the Handbook that was current at the time that you enrolled*. If you have questions about your graduate program that the graduate catalog and this Handbook do not answer, then you should consult with your Research Advisor, the departmental Graduate Advisor, or the Dean of the Graduate School. Good luck with your studies!

A. Some Introductory Information and Guidelines

The Graduate Advisor

The Graduate Advisor is a member of the Department of Chemistry and Biochemistry faculty who is in charge of overseeing the orientation of newly enrolled graduate students and the progress of each graduate student as they advance through their degree programs.

The Graduate Advisor:

- 1) Signs the Program for the Master's Degree, or the Program for the Doctoral Degree.
- 2) Notifies you of your progress in meeting the degree requirements.
- 3) Assists you in requesting to have graduate courses transferred for credit at Texas Tech.

While the Graduate Advisor will help you to decide what courses you should enroll in during your first year of graduate studies, the Research Advisor that you choose in your first year will begin to play a major role in such decisions as you progress in your studies. The Graduate Advisor can act as an intermediary between you and the departmental faculty and as an intermediary between you and the Graduate School, in cases where you need such an intermediary. It is important to emphasize that your Research Advisor will become your principal advisor/mentor once you take the important step of joining a research group.

The Graduate Advising Assistant

The Graduate Advising Assistant maintains the database system that tracks your progress with the departmental requirements. This office is located in Room 37. It is very important that the Assistant receives the required forms in a timely manner so that your records can be kept current. Until the Assistant receives the forms, the Department does not recognize that you have completed the requirement and this may cause delays in your graduation plans.

Some Basic Requirements for Graduate Study in the Dept. of Chem. and Biochem

Every student who is pursuing an M.S. or Ph.D. degree in this department must, in order to attain or maintain their eligibility for their degree, do the following:

- 1) Be registered as outlined below.
- 2) Be *solely* enrolled in a TTU Department of Chemistry and Biochemistry graduate program (i.e., not dual enrolled in another degree or certification program, whether on

- or off the TTU campus).
- 3) Meet the deadlines indicated in this Handbook for the degree requirements.
 - 4) Submit a degree plan ("Program for the Doctoral Degree" or "Program for the Master's Degree") by the deadlines listed.
 - 5) Maintain a GPA of 3.0 or higher in graduate coursework.
 - 6) Complete the required number of graduate credit hours (SCH) for the degree.
 - 7) Complete the Final Examination requirement to the satisfaction of the student's Advisory Committee by the established deadline.

Research Ethics, Student Code of Conduct, and Responsible Conduct of Research (RCR)

Every student who is pursuing an M.S. or Ph.D. degree in this department is expected at all times to conduct themselves in a highly ethical and responsible manner. This expectation cuts across all aspects of graduate student life—coursework, exams, teaching duties, laboratory research, and scientific publication. Failure to do so in any such arena will be regarded as a serious offense that could lead to dismissal from the graduate program.

That said, we recognize that it may not always be clear to new graduate students—who come to TTU from diverse backgrounds—exactly which types of behaviors may be acceptable, and which are not. To help you in this regard, we provide you with many resources. Some of these take the form of explicit requirements that you must satisfy, in order to complete your graduate degree. For instance, before you can begin to work in a research laboratory, you must first have successfully completed chemical laboratory safety training (<http://www.depts.ttu.edu/chemistry/Safety/index.php>).

As another example, all Ph.D. students must successfully complete a graduate level course focused on research ethics and/or RCR (p. 8). Note that *all* graduate students supported on federal grants must receive such training; consult your advisor, the TTU Ethics Center (742-1506), or the TTU Office of Responsible Research (742-3904) for further details.

The two TTU offices mentioned just above are always available to you if you have questions or concerns. General queries are more suited to the former office, whereas specific issues are best addressed to the latter. Concerns of a more personal or sensitive nature, particularly if they involve a Research Advisor or other direct supervisor, can be addressed to the TTU Student Resolution Center (742-SAFE), without fear of reprisal. More details may be found on their website,

<http://www.depts.ttu.edu/studentresolutioncenter/>.

In addition to these resources, there is much information that can be found on various TTU websites, and in various downloadable TTU Operating Procedure (OP) documents. Students must adhere to all guidelines and standards as discussed in the Texas Tech University Code of Student Conduct and Operating Procedure on Student Misconduct, which may be found at the websites listed below.

<http://www.depts.ttu.edu/studentjudicialprograms/conductcode.php>

<http://www.depts.ttu.edu/opmanual/OP34.12.pdf>

<http://www.depts.ttu.edu/opmanual/OP34.04.pdf>

Further details regarding acceptable student conduct may be found here:

<http://www.depts.ttu.edu/studentconduct/academicinteg.php>

<http://www.depts.ttu.edu/vpr/integrity/index.php>
http://www.depts.ttu.edu/dos/docs/entire_student_handbook.pdf

Finally, here are some sources that discuss plagiarism and intellectual property:

<http://www.hhmi.org/resources/labmanagement/moves.html>
<http://www.depts.ttu.edu/vpr/faculty/scholarly-messenger/stories/Plagerism.php>
<http://www.depts.ttu.edu/opmanual/OP74.04.pdf>

B. Registration Requirements, Coursework, and Grading

Registration Requirements

1) University Enrollment Requirements

The credit hour minimum for registration is governed by Texas Tech University Operating Policy and Procedures Manuals, OP 64.02, which states

Full-time Study: “Students must be enrolled full time (at least 9 hours in each long term, 3 hours in each relevant summer session) to be eligible to hold fellowships, teaching assistantships, graduate part-time instructorships, research assistantships, or other appointments designed for the support of graduate study, as well as to qualify for certain types of financial aid. All international students are required by law to have full-time enrollment in every long semester. Graduate students designated **PGRD** (those who have earned an undergraduate degree but who will take only undergraduate courses) may not be appointed to teaching assistantships, graduate part-time instructorships, or research assistantships, as noted in the *Graduate Catalog*. If a student is devoting full time to research, utilizing university facilities and faculty time, the schedule should reflect at least 9 hours enrollment (at least 3 hours in each summer session). Enrollment may include research, individual study, thesis, or dissertation. *Exceptions to full-time enrollment for employment purposes require approval by the graduate dean.*”

Continuous Enrollment: “Each student who has begun thesis or dissertation research must register in each regular semester and at least once each summer until the degree has been completed, unless granted an official leave of absence from the program for medical or other exceptional reasons.”

2) Chemistry and Biochemistry Seminar Enrollment Requirements

M.S. Students: Registration in two different Fall semesters (CHEM 5101) and two different Spring semesters (CHEM 5102) is minimally required. Ordinarily this requirement is fulfilled during the first two years of graduate study. However, if the literature seminar requirement is not satisfied at the end of the fourth semester of enrollment, continued enrollment in CHEM 5101 and/or CHEM 5102 is required until the literature seminar requirement is satisfied.

Ph.D. Students: Registration in two different Fall semesters (CHEM 5101) and two different Spring semesters (CHEM 5102) is minimally required, and thereafter until admission to candidacy. Ordinarily this is fulfilled during the first two years of graduate study. However, if admission to candidacy requires more than two full calendar years, or if the literature

seminar requirement is not satisfied by the end of the fourth semester of enrollment, continued enrollment in CHEM 5101 and/or CHEM 5102 is required until these other requirements are satisfied.

3) Chemistry and Biochemistry Ethics/RCR Training Requirements

Ph.D. Students: The Ph.D. degree will require successful completion of a graduate course focused on research ethics and/or RCR. By “graduate course” is meant an academic course offered for graduate credit (at least one hour) at Texas Tech University. In most cases, it is expected that this will be PHIL 5125, Research Ethics. However other related TTU (or non-TTU) academic courses may be substituted, with the approval of the Graduate Affairs Committee. By “successful completion” is meant a grade of A, B, or C.

M.S. Students: Although there is currently no formal departmental ethics/RCR training requirement for M.S. students, completion of PHIL 5125 is nevertheless strongly recommended (though this will *not* count towards the 15 total credit hour science lecture course requirement).

4) Additional Registration Requirements

The Graduate School requires a minimum of 30 hours of graduate work for the Master's Degree and a minimum of 72 hours of graduate work for the Ph.D. Degree. Most students must take more than the minimum to complete their degrees. Additional tuition and fees will be charged if the number of doctoral hours taken exceeds 130 hours for doctoral students. However, doctoral students with more than 99 doctoral hours may be dismissed or fined if they are not making progress toward their degree. On the basis of 9 hours per long semester and 3 hours per summer session, Ph.D. students will have a bit more than four years, if they already have an M.S. Degree, and a bit more than five years, if they do not have an M.S. degree, to complete their degree program, before incurring these additional fees and/or tuition charges. Note that students who already have an M.S. “start the clock” with a certain number of doctoral hours, at the start of their Ph.D. programs. In either case, it is imperative that students pursue their studies in a timely fashion to avoid these financial penalties. There are no credit limitations for M.S. students.

A typical 9 credit hour course load for first-year students is two or three lecture courses, a varying number of research credit hours (CHEM 7000), and the seminar course. After the first year, a typical course load is one or two lecture courses, research (CHEM 7000), and the seminar course. Within a year or two of graduation, as students approach the writing of their thesis or dissertation—i.e., after the second year for M.S. candidates, or typically the third or fourth year for Ph.D. candidates—students may begin enrollment in CHEM 6000 (thesis hours) or CHEM 8000 (dissertation hours). Ph.D. students cannot enroll in CHEM 8000 (dissertation hours) until after they have been admitted to candidacy. In any case, once CHEM 6000/8000 enrollment has begun, a student must continue to enroll in at least one credit hour of CHEM 6000/8000 for every semester thereafter, until completion of the degree.

During the summer, when few if any graduate lecture courses are offered, the typical course load is for thesis/dissertation and research.

Grading

A grade of “CR” (for “credit”) is assigned for the thesis (CHEM 6000) or dissertation (CHEM

8000) credit hours taken each semester, while a letter grade (from “A” to “F”) is assigned for CHEM 7000 credit hours taken each semester. A letter grade is assigned for the thesis or dissertation credit hours after the student has passed his/her final oral examination. The CHEM 7000 grade is assigned for first-semester students by the Graduate Advisor, based on the effort that the student has made in interviewing prospective Research Advisors. Once a student has chosen a Research Advisor, then it is that Research Advisor who assigns the student's grade in CHEM 7000, based upon that student's effort and progress on his or her research project. Note that *all students must complete qualified Laboratory Safety Training and Chemical Hygiene Plan Training before being able to work in a research lab and be registered for CHEM 7000.*

Course Offerings

The Graduate Catalog lists the courses offered by the department, as well as graduate-level (i.e. with numbers of 5000 or greater) courses offered by other departments on campus. A limited number of graduate-level courses from departments other than the Department of Chemistry and Biochemistry can be taken and counted toward a chemistry graduate student's degree plan. Each division also has lecture courses that are required for students specializing in that area (for both M.S. and Ph.D., unless otherwise stated):

<u>division</u>	<u>courses</u>
Analytical Chemistry (at least two req'd, only for Ph.D.)	Advanced Analytical Chemistry (CHEM 5314) Analytical Separation Science and Tech. (CHEM 5318) Analytical Spectroscopy (CHEM 5320) Electrochemical Analysis (CHEM 5319)
Biochemistry	Any five, 5000-level CHEM courses designated as “biochemistry” courses, including but not limited to: Enzymes (CHEM 5337); Lipids (CHEM 5336); Nucleic Acids (CHEM 5339); Physical Biochemistry (CHEM 5335); Proteins (CHEM 5333).
Chemical Biology	This is a new and distinct M.S. program, with both thesis and non-thesis options, which will have its own graduate handbook. Consult with the Chemical Biology Program Director for details.
Chemical Education	see the section entitled “Requirements for M.S. and Ph.D. Degree with Specialization in Chemical Education.”
Chemical Physics	see the section entitled “Requirements for M.S. and Ph.D. Degree with Specialization in Chemical Physics.”
Inorganic Chemistry (each req'd only for Ph.D.)	Advanced Inorganic Chemistry I (CHEM 5301) Advanced Inorganic Chemistry II (CHEM 5302)
Organic Chemistry	Advanced Organic Chemistry I (CHEM 5321)
Physical Chemistry	Intro to Quantum Chemistry (CHEM 5342)

In addition, each division offers, at various times, “topics” courses (CHEM 5304 Topics in

Chemistry), with specific sections dedicated to each division or topic. CHEM 5304 may be repeated for credit if a different topic is covered. Indeed, different sections of CHEM 5304, each covering a different topic, may be taken in the same semester.

The Biochemistry Laboratory (CHEM 3313) taught each Spring semester, is recommended for all biochemistry students who did not have a biochemical methods course as an undergraduate. (Enrollment in this course is at the discretion of the student and his or her research advisor.) This course does not count toward required hours.

Transfer of Graduate Credits from Other Institutions

If you have earned credit for graduate courses at other institutions that are equivalent to ones offered in our department, then you may petition to have these courses included in your degree program. In order to initiate course transfers, fill out the “Course Transfer Request” form on the departmental website under “Current Graduate Students”, attach the appropriate documentation and give it to the Graduate Advising Assistant. This information will be conveyed to the division normally involved in teaching this course along with the scores on your diagnostic exam. You will be informed of the division's decision on your request through a memo from the Graduate Advisor.

Lecture Course Requirements

For the M.S. degree in specializations different than chemical education, a minimum of 15 science lecture course hours are required. Most lecture courses are worth three credit hours, although increasingly, one-credit-hour lecture courses are now being offered. At least 12 of the 15 credit hours must come from three-credit-hour courses, i.e. three one-credit-hour lecture courses may be used for the remainder. The ethics and seminar courses do not count as science lecture courses.

For the Ph.D. degree in specializations different than chemical education, a minimum of 18 science lecture course hours are required, of which at least 15 hours must come from three-credit-hour courses. However, an additional requirement for Ph.D. students is that the combined hours from lecture, ethics, and seminar courses must total at least 24.

If allowed by the division and research advisor, some science lecture courses outside of the division and/or department may contribute to the above totals—although the Graduate Catalog stipulates that these may be included only “if they provide coherent support for the program courses in the major,” and that “courses listed for the major will be primarily in one academic program.” For the M.S. and Ph.D. degrees with a specialization in chemical education see the section entitled “Requirements for M.S. and Ph.D. Degree with Specialization in Chemical Education.”

The choice of which courses you should take in order to fulfill your coursework requirements will be made by you, based on your area of specialization, the requirements that the division of your area of specialization may make, and on the special training that your research project may require. You should seek the advice of your Research Advisor.

In summary, graduate credit hours must be distributed so that there are at least

Masters Candidates:

15 graduate level science lecture course hours

4 hours in graduate seminar (CHEM 5101 and/or 5102; one credit hour per semester)
5 hours in research (CHEM 7000), and
6 hours in Master's Thesis (CHEM 6000)

Doctoral Candidates:

24 graduate-level science lecture, ethics, and seminar course combined hours:
 18 science lecture course hours;
 4 seminar course hours (CHEM 5101/5102);
 1 ethics course hour (PHIL 5125 or approved substitute);
 1 additional course hour (e.g., CHEM 5104 Topics in Chemistry)
36 hours in research (CHEM 7000), and
12 hours in Doctoral Dissertation (CHEM 8000)

C. Additional Requirements for the M.S. and Ph.D. Degrees

An explicit checklist of requirements for each of the two degrees can be found on pp. 25 - 27 of this Handbook; you and your Research Advisor should each maintain a copy in order to ascertain your progress toward the degree. Also, be sure to consult the Graduate Catalog for the year that you entered the program to determine the Graduate School requirements that you must meet.

II. DISCUSSION OF DEGREE REQUIREMENTS

A. Diagnostic Examination Requirements

Each entering graduate student must demonstrate sufficient working knowledge of basic undergraduate chemistry in their area of specialization, and must be assessed in two other areas of chemistry, as determined by scores on “diagnostic” examinations. These are organized in two tracks. For most students they will be the standardized, multiple-choice tests written by the American Chemical Society. In format, these resemble the advanced chemistry subject GRE exam.

For students pursuing biochemistry, who possess an undergraduate degree that emphasized biology over chemistry, there is a special series of diagnostic exams: Biological Chemistry, Parts 1, 2, & 3.

- Part 1 addresses biochemistry including the chemical and physical properties of protein enzymes, nucleic acids, carbohydrates, lipids and membranes.
- Part 2 addresses metabolism including bioorganic chemistry pathways and their regulation.
- Part 3 addresses cell and molecular biology.

Students who enter the Graduate Program with combined general GRE scores (verbal + quantitative) of at least 300 (1100 on the old GRE scale) and an advanced chemistry subject GRE score in the 80th percentile, are exempt from taking the diagnostic examinations. Students specializing in Biochemistry are exempt from the Biological Chemistry diagnostic requirement* if they have combined general GRE scores of at least 300 and an advanced biochemistry, cell and molecular biology subject GRE score in the 80th percentile. Students specializing in chemical physics are exempt from the requirement of taking and passing the physical chemistry diagnostic exam, if they demonstrate a combined general GRE score of at least 300 and an 80th percentile or higher ranking on the physics subject GRE; however, these students must still take two additional chemistry diagnostic exams in other areas.

Apart from the above exceptions, all entering graduate students must take three diagnostic exams at their first opportunity after arriving at Texas Tech, one of which should be in their area of specialization. If the exam in the specialization area is not passed in the first attempt, the student will be provided with a second chance to pass this exam, at the next available opportunity approximately one semester later. All students *must* pass the diagnostic exam in their specialization area within these first two opportunities, in order to remain in the graduate program in the Department of Chemistry and Biochemistry. The exams are offered by each of the divisions of the Department of Chemistry and Biochemistry prior to registration for each fall and spring semester, and at the end of the spring semester. Each exam is comprehensive, three hours in length, and covers undergraduate material only. Each student must select the three fields in which he/she will take the diagnostic exams according to the following requirements:

<u>Area of specialization:</u>	<u>Required Exams:</u>
Analytical Chemistry	pass Analytical Chemistry, take any two others
Biochemistry*	pass Biochemistry, take any two others. Physical Chemistry for Biological Sciences may be substituted for the regular Physical Chemistry exam (only students in Biochemistry are allowed to make this substitution).
Chemical Education	see "Requirements for M.S. and Ph.D. Degree with Specialization in Chemical Education."
Chemical Physics	pass Physical Chemistry, take any two others
Inorganic Chemistry	pass Inorganic Chemistry, take any two others
Organic Chemistry	pass Organic Chemistry, take any two others
Physical Chemistry	pass Physical Chemistry, take any two others

*Students pursuing biochemistry may opt to take the Biological Chemistry diagnostic exam track. This option is available only to biochemistry students. If you are uncertain as to your area of specialization, you should not take this track. A successful completion cannot be achieved by combining passes from the Biological Chemistry series with passes from the other track of diagnostic examinations. Instead, there are three ways to pass the Biological Chemistry series:

- (a) 50% or better on all three Biological Chemistry exams, –OR–
- (b) 60% or better on two out of three Biological Chemistry exams, –OR–
- (a) 67% or better on one out of three Biological Chemistry exams

If you do not pass the diagnostic exam in your specialization area on your first attempt, then you must engage in self-study (possibly including not-for-credit enrollment in an undergraduate-level course) in that subject prior to retaking the exam the next time that it is offered.

Please note the following additional information relating to diagnostic requirements:

- 1) Graduate students specializing in biochemistry and who have not taken an undergraduate laboratory course in biochemistry (or do not have laboratory experience in biochemistry from prior graduate-level research work) must take CHEM 3313 ("Biological Chemistry Lab," offered in the Spring), even if they have passed the Biochemistry diagnostic examination. This CHEM 3313 course will not count toward the student's graduate degree.
- 2) Entering students who petition the Department to have graduate-level courses that they have taken elsewhere transferred for credit toward their Ph.D. program will have their diagnostic exam performances scrutinized as part of the approval process.

B. Choosing a Division, Research Advisor, and Advisory Committee

Your Division

At the time you enter the graduate program, you will also select a Division of the department that best represents your area of specialization. This choice will determine your specific diagnostic exam, cumulative exam, seminar, and course requirements. You may choose a Division other than that of your Research Advisor, but your choice should be appropriate for your research project. The departmental Divisions are: Analytical Chemistry, Biochemistry, Chemical Education, Inorganic Chemistry, Organic Chemistry, and Physical Chemistry.

Your Research Advisor

During your first long semester, you must select a Research Advisor, the professor with whom you will do research work in your graduate career. This professor becomes your primary advisor and is in charge of your work and your program. Your Research Advisor is the key person in your graduate work. To acquaint yourself with the research activities of the faculty, you must talk with at least three professors before making a choice. A form to record these three interviews can be found on the departmental website under “Current Graduate Students”; it should be signed by all the professors with whom you interview. You must return the form with the three signatures to the Graduate Advising Assistant before the end of the first semester. By this time you should have found a professor with whom you wish to work and who has agreed to mentor you, and in this case, the faculty member should have signed the form. If you have not yet found a mutually acceptable advisor, you must nevertheless turn in the interview form at the end of your first semester and work diligently to find an advisor as soon as possible. If you are having unusual difficulties finding an advisor, feel free to discuss the matter with the Graduate Advisor.

You are urged to consider all factors carefully before making this important choice. It is often helpful to talk to experienced graduate students, especially those working with professors being interviewed, in order to get their opinions. Remember, also, that many professors have research projects in areas outside the area of their normal teaching duties. Again, feel free to discuss this with the Graduate Advisor. Please note also that *your choice of Research Advisor requires final approval by the Department Chair.*

Your Advisory Committee

The Advisory Committee is the group of faculty who, along with your Research Advisor, will evaluate your progress toward your degree, offer guidance on your research project, and assess your qualifications for the degree via oral examination.

The Advisory Committee for the Master's degree study must consist of at least *two* individuals, your Research Advisor (the chairperson of the committee) and at least one other member of the Chemistry and Biochemistry faculty.

The Advisory Committee for the Doctoral degree must consist of at least *three* individuals, your research advisor (the chairperson) and at least two other faculty members. There should be no more than 5 members on your committee. Your committee is typically made up of faculty from the Department of Chemistry and Biochemistry, but your particular research project may merit the inclusion of faculty from other departments.

You choose your Advisory Committee by considering, with the advice of your Research Advisor, a list of faculty whom you think would be most appropriate (based on the nature of your research project), then asking each of those faculty if he/she would be willing to serve on your committee. (In some cases, a faculty member will decline serving on your committee due to impending absences from the department or other circumstances). The members of your committee will be listed on the degree program that you will submit to the Graduate School, through the Graduate Advising Assistant.

If a member of your committee leaves the university, or for some other reason can no longer serve on your committee, then you can replace him/her with another faculty member, and notify the Graduate School of this change by submitting a “Change of Degree Plan” form which must be signed by the Graduate Advisor. The “Change of Degree Plan” form is in the Graduate Advising Office, Room 37.

C. Degree Program Forms

In order to be approved by the Graduate School for completing your degree, you must submit a completed degree program to them, through the Graduate Advising Assistant, according to the deadlines indicated above. These forms (one for the M.S. and one for the Ph.D. degree) require, in addition to your name and address, the following:

- Your thesis/dissertation topic (a preliminary *title* for your thesis/dissertation)
- The names of the members of your Advisory Committee
- A list of the courses that you have taken, or intend to take, in order to fulfill the coursework requirements for the degree
- Your expected graduation date, which will be May, August, or December of some year in the future.

Note that *anything* designated on your degree program—thesis/dissertation title, Advisory Committee members, courses, graduation date—can be changed by submitting a signed (by the Graduate Advisor) “Change of Degree Plan” form to the Graduate School. The “Change of Degree Plan” form is in the Graduate Advising Office, Room 37.

The degree program forms are straightforward to complete, but you should feel free to show the Graduate Advisor a rough draft before you submit the final version to him or her for approval. Samples of completed forms can be found in Room 037. Blank forms are on the departmental website under “Current Graduate Students”.

One thing to note about your degree program is that *the Department of Chemistry and Biochemistry does not require that you choose a minor area of study.*

D. Literature Seminar Requirements

The requirements for both the M.S. and Ph.D. graduate degrees include the presentation of one acceptable literature seminar by the end of the fourth long semester. The seminar requirement is satisfied by the formal presentation of a 50-minute lecture on a specific topic that you have chosen

in your major area that is not directly related to your research project. Each seminar is presented as a divisional seminar, but it must be formally announced to the department as a whole and be open for attendance by all interested listeners. Most divisions require that a written abstract of the seminar topic be prepared for distribution at the time of the seminar; if so, you must first submit this abstract to iThenticate (see Research and Future Work Exam, p. 16), and then give the results to your Research Advisor, prior to your seminar.

You should discuss the appropriateness of your chosen seminar topic with your Research Advisor and seek his/her advice during the preparation of your seminar. Furthermore, you should make a special effort to arrange for the members of your Advisory Committee to attend your seminar. The faculty attending your seminar will evaluate your performance, after which your Research Advisor will notify the Graduate Advisor when you have successfully completed this requirement. In order to assist your Research Advisor in this, present him or her with a copy of the "Report of Literature Seminar" form which can be found on the departmental website under "Current Graduate Students"; he/she must sign the form and submit it to the Graduate Advising Assistant.

E. Qualifying Examination for Ph.D. Students

The Qualifying Examination for the Ph.D. degree in Chemistry consists of the Research and Future Work Examination, together with the Cumulative Examinations. Exact deadlines (indicated in the summary on p. 26) exist for each part of the Qualifying Examination, and the failure of a student to abide by these deadlines will result in his/her disqualification from the Ph.D. program of the Department of Chemistry and Biochemistry. Success in both parts of the qualifying examination will qualify the student for admission to candidacy. A suitable form must be filled out and signed by the research advisor, and submitted first to the graduate advising office, and then to the graduate school.

Research and Future Work Examination

By the end of a student's second calendar year as a graduate student in the department, the student must submit a detailed written report of his/her research project to his/her Advisory Committee, and meet with the committee to orally discuss the research project and answer questions as part of the oral examination. The written report should be 6-10 pages long, and be subdivided into sections suitable for a short research proposal (e.g., "Aims", "Background", "Preliminary Results", "Research Plan", etc.) The oral examination should consist of a 30-45 minute presentation by the student, with the subsequent question-and-answer session not necessarily limited to the presentation topics, but also designed to encompass the broader, contextual scope of the student's scientific understanding, vis-à-vis the research project. Both written and oral components of the Research and Future Work Examination must include substantive discussion of both the preliminary research progress conducted thus far, as well as future work proposed as part of the student's Ph.D. research project. Students should enlist the aid of their Research Advisors during their preparation for the examination. Having established a framework, baseline, and benchmarks for expected outcomes, students who have passed the Research and Future Work Examination are encouraged to submit subsequent progress reports to their Advisory Committees once per year.

The primary purpose of the Research and Future Work Examination is to evaluate the development of the student into a Ph.D.-caliber scientist. Thus the committee will expect the student to demonstrate:

- scholarship (development of a strong background in the subject),
- ability (development of expertise in the techniques required by the project),
- communication skills (development of expertise in presenting the research subject and discussing it on an *ad hoc* basis), and
- creativity (development of the ability to solve problems independently and to foresee research directions which may be revealed by the research project).

A secondary purpose of the Research and Future Work Examination is to allow the various committee members to critique the student's research project, and to offer advice about its design, direction, and feasibility.

Prior to the oral examination session, the student must submit the written component to iThenticate, and then give the results to all members of the Advisory Committee. iThenticate is software that automatically checks a given document against many related documents found on the web, in order to ensure originality. TTU graduate students may submit their own works to iThenticate through the TTU library, at the following website:

<http://library.ttu.edu/ithenticate/ithenticate.php>.

Upon completion of the oral examination session, the committee will vote on whether or not the student has demonstrated sufficient development as a pre-doctoral student to assure ultimate success in attaining the Ph.D. degree. If the committee votes that the student has *not* demonstrated sufficient development, then it will recommend that the student be disqualified from pursuing a Ph.D. degree in the department, and the Graduate School will be notified that the student has failed his/her qualifying examination. In some cases, the committee might vote that a student retake all or part of the examination (e.g. repeat the oral part or rewrite the written part).

When a student has successfully completed the Research and Future Work Examination, he/she must have his/her research advisor and committee sign a “Report of Research and Future Work Examination” form (a blank copy of this form is on the departmental website under “Current Graduate Students”). The completed form must then be submitted to the Graduate Advising Assistant.

Any student who does not successfully complete his/her Research and Future Work Examination by the end of his/her second calendar year (August 31 for Fall entering students, December 31 for Spring entering students) will fail the qualifying examination, and will be disqualified from pursuing the Ph.D. in the Department of Chemistry and Biochemistry.

Cumulative Examinations

Cumulative examinations are administered approximately once per month during the academic year (September through April), on Saturday mornings, according to a schedule distributed to students and posted on the Departmental website under “Current Graduate Students” before the beginning of the academic year. A total of three cumulative examinations will be offered each long semester.

Each division in the department, including Chemical Education, will offer a cumulative examination on each scheduled date. On a given exam day, it is permissible for students to attempt a cumulative examination in an area outside of their specialization, although it is expected that the

majority of the exams taken will be within the specialization area (but see “Requirements for M.S. and Ph.D. Degree with Specialization in Chemical Education,” if this is applicable).

The purpose of the cumulative examinations is to encourage and measure the development of a student's comprehension of advanced-level topics in his or her area of specialization—as a means of gauging his or her likelihood of success in completing the doctoral degree, and potential to become a productive member of the scientific community, in the specialization area. The questions may vary from detailed essay questions to calculations to short answers. A common format for a cumulative examination is a series of questions about some recent journal article (or articles) that must be answered in blue books which accompany the examination. In general, the exams will emphasize data interpretation and problem solving (i.e. given these data, tell us what happened? How did it happen? How could you change what happened?) Depending upon the division giving the exam, the topic of a cumulative examination may or may not be announced beforehand (different divisions follow different procedures in this regard). A file of cumulative examinations is maintained in Room 37 for students to examine in order to assess typical questions.

The departmental rules concerning cumulative examinations are as follows:

- a) Starting with the first month of the first semester that a student enters the department's Ph.D. program, a student must pass at least one cumulative exam by the last month of his/her second long semester in the Ph.D. program, and he/she must pass four cumulative examinations by the last month of his/her fourth long semester in the Ph.D. program.
- b) A student is allowed to attempt no more than a total of 12 cumulative examinations. Each examination paper (bluebook) handed in by a student at the end of an examination period is counted toward this total.
- c) If a student has not passed the required number of cumulative examinations within the time and/or number constraints indicated above, then the student will have failed the qualifying examination, and will be disqualified from pursuing the Ph.D. degree in the Department of Chemistry and Biochemistry.
- d) Students are permitted to attempt an exam(s) and then leave the testing room with a copy of that exam(s) prior to the end of the testing period, *without* submitting the exam for grading. Exams that are not submitted to the proctor will not count as an attempt; however exams cannot be taken from the testing room and then later turned in to the grader after the testing period has ended.

Note that students are allowed to hand in more than one completed cumulative examination paper on a single Saturday, i.e. more than one exam may be attempted per exam date. However, *all* exams that are handed in count toward the 12-examination limit; thus in such cases the student may meet his or her 12-examination limit *before* the end of his or her fourth long semester. Conversely, a student who turns in no exams on a given Saturday, whether he/she was present or not, will not be given extra exam-taking opportunities.

F. Final Oral Examination (Thesis/Dissertation Defense)

Final Oral Examination for M.S. Degree

The Final Oral Examination consists of an oral presentation, in seminar format, of your research results, followed immediately by an oral examination session in which your committee members

ask you questions about your research project and related subjects. The presentation for the M.S. degree does not have to be open to the public; typically it is made to your committee. You must present copies of your thesis to your committee at least a week before the oral examination. Following the oral examination, your committee will decide if you have passed the examination or not, and they will recommend changes in your thesis based on their reading of it. When your committee has decided that you have passed the examination and you have corrected the thesis according to their instructions, you must prepare a final copy of your thesis and submit it to the Graduate School for their approval. It is important that you pay close attention to the deadlines and thesis format requirements set by the Graduate School when you are completing your M.S. degree requirements.

As soon as a date and time has been arranged with your committee members for your Final Oral Examination, you need to reserve the room through the appropriate departmental personnel. The Final Oral Examination must be announced on the weekly departmental seminar list. The title, as well as a copy of an abstract, should be given to the appropriate departmental personnel by Thursday of the week preceding your Final Oral Examination.

Final Oral Examination for Ph.D. Degree

The Final Oral Examination must be announced via a formal announcement that follows format guidelines established by the Graduate School. The examination may not be administered until at least *three weeks* after the announcement has been submitted to the Graduate School. Copies of this announcement will be mailed throughout the campus, and the Graduate School will select a graduate school dean's representative to serve as an additional member of your committee to participate in the final oral examination and report to the Graduate School about the examination. As stated in the Graduate Catalog, *your Advisory Committee must approve the first written draft of the dissertation before the oral examination is scheduled.*

The final oral examination for the Ph.D. degree will consist of a *public* presentation of your research results in the form of a 50-minute seminar. This presentation will be followed by a period of questions from the public audience, then a closed-door oral examination by your Advisory Committee. You must present a copy of your dissertation to each member of your committee (including the dean's representative) *at least one week* before the date of your final examination. Following the oral examination, your committee will decide if you have passed the examination or not, and they will recommend changes in your dissertation based on their reading of it. When your committee has decided that you have passed the examination and you have corrected the dissertation according to their instructions, you must prepare a final copy of your dissertation and submit it to the Graduate School for their approval. Your Research Advisor will notify the Graduate School at this time that you have successfully completed your final oral examination. It is important that you pay close attention to the deadlines and dissertation format requirements set by the Graduate School when you are completing your Ph.D. degree requirements.

As soon as a date and time has been arranged with your committee members for your Final Oral Examination, you need to reserve the room through the appropriate departmental personnel. The Final Oral Examination must be announced on the weekly departmental seminar list. The title, as well as a copy of an abstract, should be given to the appropriate departmental personnel by Thursday of the week preceding your Final Oral Examination.

To clarify the process by which a doctoral student obtains preliminary approval of his/her dissertation from his/her doctoral committee members prior to the scheduling of his/her Final Oral Examination with the Graduate School, the following procedure is established.

- 1) The committee members will provide a preliminary evaluation of the dissertation within seven days of its acceptance from the candidate for review.
- 2) If a committee member feels that major changes are required, this will be communicated to the candidate within the seven-day period. Such major changes will have to be made by the student and the committee members will have another seven days to evaluate the revised dissertation once they accept it for review.
- 3) If only minor changes are required, the committee member will give preliminary approval to the dissertation. (Note that some modifications of the dissertation will undoubtedly still be required after the dissertation defense. However these will be of a relatively minor nature and will not involve, for example, the rewriting of an entire chapter.)
- 4) If the candidate receives no communication from a committee member by the end of the seven-day period, it will be assumed that committee member has given preliminary approval to the dissertation.

III. APPENDICES

A. Requirements for M.S./Ph.D. Degree with Specialization in Chemical Education

For students wishing to pursue a graduate degree with a specialization in Chemical Education, the requisite guidelines are somewhat different from the other specialization areas, as explained in detail in this section. In all cases, the goal is to provide the student with a firm grounding in both chemistry or biochemistry and education, while not extending the student's stay much past that of a chemistry/biochemistry degree in a traditional area.

The M.S. degree program in Chemical Education is designed for students interested in teaching careers at the secondary level, at the two-year college level, as well as at four-year colleges and universities. This degree is appropriate for high school teachers wishing to expand their content and educational backgrounds. However, it is also appropriate for those individuals wishing to teach in a post-secondary education setting. Typically, those interested in pursuing a Ph.D. in a traditional area of chemistry with the goal of pursuing an academic career at a liberal arts college or university will find that the M.S. in Chemical Education gives them a competitive edge in the job market because of their experience with education. In any case, the M.S. degree in Chemical Education is a stand-alone (i.e. "self-contained") degree program.

The Ph.D. degree program in Chemical Education is designed for students interested in research and/or teaching careers at the secondary level, at the two-year college level, as well as at four-year and Ph.D. granting colleges and universities.

IMPORTANT NOTE FOR 2015: The guidelines for the Specialization in Chemical Education are currently being reevaluated. Entering students with an interest in this program should consult with the Graduate Advisor for further details.

B. Requirements for M.S./Ph.D. Degree with Specialization in Chemical Physics

The main goal of this specialization is to prepare students who wish to study chemical problems by the methods and theories of modern physics. This specialization includes courses in chemistry, physics, and mathematics and research on a suitable problem under the direction of a faculty member in the Department of Chemistry and Biochemistry or the Department of Physics. It is envisioned that a large fraction of students who choose the chemical physics specialization will be chemistry students with strong backgrounds in mathematics and physics. However, the academic requirements for the chemical physics specialization should make it also attractive to physics students. Because the coursework is difficult, this specialization will be recommended to students who are academically strong in chemistry, physics, and mathematics, as judged by transcripts and test scores.

Since this specialization will be administered in the Department of Chemistry and Biochemistry, the academic requirements are similar to those that are currently required in the other areas of chemistry. In particular, these requirements are the same as those for the Physical Chemistry specialization area, except as explicitly discussed below.

Diagnostic Exams

Chemical physics students in both the M.S. and Ph.D. programs must demonstrate their working

knowledge of basic undergraduate chemistry and physics by taking three diagnostic exams upon arriving at Texas Tech, and passing the physical chemistry diagnostic exam within their first two opportunities. Chemical physics students may place out of the physical chemistry diagnostic requirement by scoring well on the physics subject GRE (p. 11), but must in this case still take two diagnostic exams in other areas.

Advisory Committee

The Advisory Committee for an M.S. student must consist of a minimum of two members, one of whom must be a tenure-acquiring faculty member within the Department of Chemistry and Biochemistry, and one who must be a tenure-acquiring faculty member from the Department of Physics. The Advisory Committee for a Ph.D. student must consist of a minimum of three members, two of whom must be tenure-acquiring faculty members within the Department of Chemistry and Biochemistry, and one who must be a tenure-acquiring faculty member from the Department of Physics.

Required Physics Courses

The students must show proficiency in Electricity and Magnetism and Mechanics by passing with a grade of B or better one course from Physics 3305-3306 (5315-5316) and one course from Physics 4304-4305 (5324-5325), or the equivalent courses from other institutions. Students may receive *graduate credit* for *only two* of these four courses. If taken for graduate credit, two of these courses will count as courses taken outside of the Department of Chemistry and Biochemistry, as described below.

Course Work

Masters Candidates: The 30 required graduate credit hours are distributed as follows:

- 15 graduate-level science lecture course hours
- 4 hours in graduate seminar (CHEM 5101 and/or CHEM 5102)
- 5 hours in research (CHEM 7000), and
- 6 hours in Master's Thesis (CHEM 6000)

Of the 15 lecture course hours, at least 9 must be taken within the Department of Chemistry and Biochemistry.

Doctoral Candidates: The 72 required graduate credit hours are distributed as follows:

- 24 graduate-level lecture and seminar course combined hours:
 - 18 science lecture course hours; 4 seminar course hours (CHEM 5101/5102);
 - 1 ethics course hour (PHIL 5125 or approved substitute)
 - 1 additional course hour (e.g., CHEM 5104 Topics in Chemistry)
- 36 hours in research (CHEM 7000), and
- 12 hours in Doctoral Dissertation (CHEM 8000)

Of the 18 lecture course hours, a maximum of 9 can be taken outside of the Department of Chemistry and Biochemistry.

It is anticipated that most of the lecture courses taken for the chemical physics specialization will be in physical chemistry, although some courses in other departments such as Physics and Mathematics will be accepted. Chemical physics students may also be allowed to substitute departmental physics or mathematics seminar courses for some of the Departmental Chemistry and Biochemistry seminars.

C. CHECKLIST FOR THE M.S. DEGREE IN CHEMISTRY

In Order to Earn a M.S. Degree in Chemistry, You Must:

<u>Do the Following</u>	<u>By the Following Deadline</u>	<u>Date Completed</u>
1.) Complete the Diagnostic Requirements	On or before the second available opportunity (approx. one semester; See Diagnostic Exam Requirements, p. 11)	_____
2.) Choose your Research Advisor Fill out "Interview Prospective Research Advisors Form"	End of the 1st long semester The Form is on the departmental website under "Current Graduate Students"	_____
3.) Fill out, obtain signatures on and submit the form "Program for Master's Degree" to the Graduate Advising Assistant, including specification of your Advisory Committee. (See Degree Program Forms, p. 28)	End of 1st long semester The form is on the departmental website under "Current Graduate Students". There is an example at the back of this handbook.	_____
4.) Complete an approved literature seminar to your division, as evidenced by the Graduate Advising Assistant receiving a completed, signed "Report of Literature Seminar" Form. (See Literature Seminar Requirement, p.14)	End of 4th long semester Give report to Research Advisor to sign and turn in to the Graduate Advising Assistant.	_____
5.) Complete at least 15 credit hours of graduate-level science lecture courses, plus 4 hours of seminar (CHEM 5101-5102)	Whenever completed • 4 seminars 5101/5102 • 15 credit hours of science lecture	_____
6.) Complete at least 5 credit hours of CHEM 7000 and 6 credit hours of CHEM 6000 (Master's Thesis)	Department registration requirements assure that this will be completed with extra credit hours to spare	_____
7.) Complete a research project as supervised by your Research Advisor, write up your results in a thesis which follows the Graduate School guidelines, undergo a final oral examination with your Advisory Committee and submit the requisite number of corrected copies of your thesis to the Graduate School according to the deadlines set by them each semester.	Graduate Advisor will turn in the "Thesis Successfully Completed Form" that is found on the departmental website under "Current Graduate Students"	_____
8.) Complete and submit the form, "Chemistry Graduate Student Exit Survey" to the Graduate Advising Assistant	After successful completion of the thesis and before departing Texas Tech. Form is on the departmental website under "Current Graduate Students"	_____

D. CHECKLIST FOR THE PH.D. DEGREE IN CHEMISTRY

In Order to Earn the Ph.D Degree in Chemistry, You must:

	<u>Do the Following</u>	<u>By the Following Deadline.</u>	<u>Date Completed</u>
1.)	Complete the Diagnostic Requirements	On or before the second available opportunity (approx. one semester; See Diagnostic Exam Requirements, p. 11)	_____
2.)	Choose your Research Advisor. Fill out "Interview Prospective Research Advisors Form"	End of 1st long semester The Form is on the departmental website under "Current Graduate Students"	_____
3.)	Chose at least 2 but no more than 4 other faculty members to be on your Advisory Committee.	End of 2nd long semester This is done on the "Program for the Doctoral Degree" form	_____
4.)	Fill out, obtain signatures on, and submit the form "Program for the Doctoral Degree" to the Graduate Advising Assistant. (See Degree Program Forms, p. 29)	End of 2nd long semester The form is on the departmental website under "Current Graduate Students". There is an example at the back of this handbook.	_____
5.)	Successfully Complete four Cumulative Examinations (See pp. 16-17)	End of 2nd long semester for the first exam; end of fourth long semester for all four exams	_____
6.)	Complete an approved literature seminar to your division, as evidenced by the Graduate Advising Assistant receiving a completed, signed "Report of Literature Seminar" Form. (See Literature Seminar Requirement, p.14)	End of 4th long semester Give report to Research Advisor to sign and turn in to the Graduate Advising Assistant.	_____
7.)	Submit a detailed written report to your committee, meet with them to give a 30-45 minute oral presentation (followed by question and answer session) on your research project. Both written and oral components must include substantive discussion of both progress thus far, as well as proposed future work. (See Research and Future Work Examination on p 15-16)	End of second calendar year Fill out "Report of Research and Future Work Examination," get it signed by Research Advisor and turn in to Graduate Advising Assistant.	_____
8.)	Become admitted into candidacy for the doctoral degree. [The date is important; see p. 27 below]	Research Advisor and the Graduate Office will submit your name for candidacy when you have passed your 4 th Cumulative Exam and your Research and Future Work Exam. Turn in form "Report of Research and	_____

	Future Work Examination” to Graduate Advising Assistant.	
9.) Complete at least 24 combined credit hours of graduate-level science lectures, ethics, and seminar courses; at least 18 must be from science lecture courses, at least 1 must be from an ethics course and at least 4 from seminar courses.	Enroll in CHEM 5101/5102 each semester until admission to candidacy • 4 courses of Seminar – 1st four long semesters • 1 Approved Ethics Course • 18 hrs approved Science Lectures • 1 additional course hour (p.11)	
10.) Complete at least 36 credit hours of CHEM 7000 and 12 credit hours of CHEM 8000 (Doctoral Dissertation)	Department registration requirements assure that this will be completed with extra credit hours to spare within 4 years of the date admitted to candidacy	
11.) Complete a research project as supervised by your Research Advisor, write up your results in a dissertation which follows the Graduate School guidelines, undergo a final oral examination (which has been announced to the entire Department of Chemistry and Biochemistry, and according to the Graduate School Guidelines) with your Advisory Committee and submit the requisite number of corrected copies of your dissertation to the Graduate School according to the deadlines set by them each semester.	Within 4 years of Admission to Candidacy Give Research Advisor “Report of Successful Oral Dissertation Defense” form that is on the departmental website under “Current Graduate Students”	
12.) Complete and submit the form, “Chemistry Graduate Student Exit Survey” to the Graduate Advising Assistant	After successful completion of the dissertation and before departing Texas Tech. Form is on the departmental website under “Current Graduate Students”	

E. SAMPLE OF COMPLETED "PROGRAM FOR THE MASTER'S DEGREE" FORM

Student's R#: R000000000

Projected Graduation Date: 5/2019

Student's Name: Jones, Maria Curie

Program (drop down menu): MS

Major: Chemistry & Biochemistry

Area: Analytical

Advisor Committee Chair: Dr. May I. Pass

Other Committee Members: Dr. Del Max, Dr. Inverse Chiral, _____, _____

Thesis or Dissertation Title (or area of research for thesis or dissertation: "Electrophoresis of Carbohydrates:" or write topic of research

Coursework: Put down both courses you have taken, are taking and will take. Future changes will be made through a change in program form.

Major Courses (not including language):

CHEM 5101 2hours CHEM 5102 2hours CHEM 7000 5 hours CHEM 6000 6 hours Phil 5125 1 hour CHEM 5314 CHEM 5304 - Mass Spectroscopy	CHEM 5315 CHEM 5318 CHEM 5319
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Non major courses (ie. Languages)

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Transfer Courses

Institution

Course: CHEM 532	University: Lone Star University
TTU Equivalent: CHEM 5320	
Course:	University:
TTU Equivalent:	
Course:	University:
TTU Equivalent:	

Signature of Research Advisor

Date:

Signature of Graduate Advisor

Date

F. Sample of Completed "Program for the Doctoral Degree"

Student's R#: R000000000

Projected Graduation Date: 5/2019

Student's Name: Jones, Maria Curie

Program (drop down menu): MS

Major: Chemistry & Biochemistry

Area: Analytical

Advisor Committee Chair: Dr. May I. Pass

Other Committee Members: Dr. Del Max, Dr. Inverse Chiral, _____, _____

Thesis or Dissertation Title (or area of research for thesis or dissertation: "Electrophoresis of Carbohydrates:" or write topic of research

Coursework: Put down both courses you have taken, are taking and will take. Future changes will be made through a change in program form.

Major Courses (not including language):

CHEM 5101 2hours CHEM 5102 2hours CHEM 7000 5 hours CHEM 6000 6 hours Phil 5125 1 hour CHEM 5314 CHEM 5304 - Mass Spectroscopy	CHEM 5315 CHEM 5318 CHEM 5319
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Non major courses (ie. Languages)

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Transfer Courses

Institution

Course: CHEM 532	University: Lone Star University
TTU Equivalent: CHEM 5320	
Course:	University:
TTU Equivalent:	
Course:	University:
TTU Equivalent:	

Signature of Research Advisor

Date:

Signature of Graduate Advisor

Date