Agricultural and Environmental Chemistry Graduate Group (AGC)

MS and PhD Degree Requirements

Last Version Approved December 12, 2007; Revised March 8, 2019
Approved by Graduate Council: June 11, 2019

Master's Degree Requirements:

1. Admissions requirements

Consideration for admission to the MS program requires a bachelor's degree, three letters of recommendation, official transcripts, TOEFL or IELTS score (if applicable) and an Office of Graduate Studies online application with fee by the stated admission deadline. No GRE tests are required. The decision to recommend admission to the Dean of Graduate Studies will be made by the Program Admissions Committee on the basis of available space and the competitiveness of applicants compared to the eligible pool.

a) Prerequisites. A chemistry degree is not required, but significant coursework in chemistry is required. Applicants are expected to have scored a B or better in the equivalent of the following UC Davis courses:

i) One year of organic chemistry (including laboratory), equivalent to UC Davis Chemistry courses CHE 118 A,B,C or CHE 128 A,B,C
ii) Two quarters (or one semester) of physical chemistry (including laboratory), equivalent to CHE 107 A,B or Chemistry 110 A,B,C
iii) Two additional upper division courses in chemistry (e.g., inorganic, biochemistry, analytical, food, pharmaceutical, or environmental)

Applicants without at least one semester (or two quarters) of organic chemistry will not be admitted. Applicants missing more than two semesters of the other upper division courses in chemistry will not be admitted.

b) English-language requirement. Applicants must meet the UC Davis minimum scores on the TOEFL or IELTS, which are specified by Grad Studies policy GS2014-04.

c) Deficiencies and Placement examinations.

Students who are missing a prerequisite class, or who took the prerequisite but earned below a B grade, have two options for each missing class:

(1) The first option is to take the class as part of their MS work and earn a grade of B or better. Coursework deficiencies should be made up by the end of the first academic year. Courses taken to fulfill the prerequisite requirement do not count toward the MS Course Requirements.

(2) The second option is to pass the corresponding American Chemical Society (ACS) placement examination, which is available for organic, inorganic, and physical chemistry. Examinations are given before Fall quarter instruction begins; the Program Coordinator provides incoming students with exact dates each year. An acceptable

grade is scoring at or above the 60th percentile. A student who does not pass a placement exam can retake the exam in Winter quarter or take the class (option 1). If a student does not score above the 60th percentile on the 2nd attempt, they must take the class(es) corresponding to the portions of the exam where they scored below the 60th percentile.

Students without deficiencies. Students who have taken all of the prerequisite classes, and earned a B grade or better in each one, do not need to take the placement exams.

2. MS, Plan I and II

Plan I (Thesis). This plan requires a minimum of 30 units of graduate and upper division courses (i.e., courses in the 100 and 200 series), of which at least 12 units must be graduate work in the major field. Seminars (290) and research (299) count toward the 30-unit requirement, but not toward the 12-unit requirement. A written thesis is required as the capstone component.

Plan II (Comprehensive Exam). This plan requires a minimum of 39 units of graduate and upper division courses (i.e., courses in the 100 and 200 series), of which at least 18 units must be graduate work in the major field. Lower division units (course numbers below 100) do not count toward either of the unit requirements. The 39-unit requirement can include up to a total of 6 units combined of research (299) and internship (292); and up to 5 units of seminar (290). The 18-unit requirement for graduate coursework in the major field can include up to a total of 3 units combined of research (299) and internship (292); the internship is typically completed during the summer. Units of seminar (290) do not count toward the 18 graduate units required but do count toward the 39-unit requirement. Students must pass a comprehensive final examination, which the program administers to all MS Plan II students in the Spring and, if needed, in the summer. No thesis is required.

This Plan requires more units than the UC Davis minimum, which are 36 units of graduate and upper division courses, of which at least 18 units must be graduate courses in the major field.

3. Course Requirements

Plan I MS

a) Core courses: (7 – 8 units)

All students are required to complete (without substitution) two core courses:
(i) One of the following 3 options in the area of chemical separations and analysis:
- (a) ETX 220, Analysis of Toxicants, 3 units, and (required)
  ETX 220L, Analysis of Toxicants Lab, 2 units
- (b) CHE 219, Spectroscopy of Organic Compounds, 4 units, and (strongly encouraged)
  CHE 219L, Laboratory in Spectroscopy of Organic Compounds, 1 unit
- (c) VEN 223, Instrumental Analysis of Must and Wine, 4 units

and

(ii) One of the following 2 options in chemical reaction mechanisms:
(a) CHE 233, Physical-Organic Chemistry, 3 units
(b) CHE 226, Principles of Transition Metal Chemistry, 3 units.

b) Elective courses (12 – 17 units of Statistics and Specialization, plus an additional 7 – 9 units of seminar (290))

To fulfill the MS Plan I Elective requirements, students must take 1 course in Statistics and Experimental Design, 3 Specialization courses (at least 2 that are graduate level), and 7 – 9 units of seminar. Details on these requirements are listed below.

1) Statistics and Experimental Design (3 – 5 units)

One course in Statistics or Experimental Design must be selected from the following:

STA100	Applied Statistics for Biological Sciences	4 units
STA101	Advanced Applied Statistics for Biological Sciences	4 units
STA106	Applied Statistical Methods: Analysis of Variance	4 units
STA108	Applied Statistical Methods: Regression Analysis	4 units
STA137	Applied Time Series Analysis	4 units
STA205	Statistical Methods for Research with SAS	4 units
STA223	Biostatistics: Generalized Linear Models	4 units
ECS124	Theory and Practice of Bioinformatics	4 units
PLS205	Experimental Design and Analysis	5 units
PLS206	Applied Multivariate Modeling in Ag & Env Sciences	4 units
VEN215	Sensometrics	3 units

2) Specialization (9 -12 units)

MS Plan I students are required to register for, and complete, 3 letter-graded lecture courses, with at least 2 having a strong chemistry emphasis. At least 2 of the 3 courses must be at the graduate level; one of the 3 courses may be upper-division with approval by the Graduate Advisor. A list of suggested elective courses is available on the Group's web site and is included here as Appendix A. Students are encouraged to recommend to the Chair and Educational Policy Committee other existing courses that could serve as specialization courses.

3) Seminar (7 – 9 units)

Students in their first year are required to register for AGC 290-002 each quarter. This corresponds to the Meet the Faculty Seminar in the Fall, the Mechanics of Presenting a Seminar course in Winter, and Journal Club in Spring.

In addition, during the first year and every subsequent year all students are required to register for and satisfactorily complete Seminar/Colloquium (AGC 290-001) each quarter it is offered (typically the Fall and Winter quarters) and they are registered. Students engaged in research or coursework that prevents their attendance may be exempted from this requirement with the approval of the faculty seminar sponsor if arranged within the first 2 weeks of the quarter; if exempted from 290-001, students are expected to register for another seminar series that quarter.

c) Summary

The Plan I MS requires 7-8 units of Core Courses, 12-17 units of Elective Courses in Statistics and Specialization, 7-9 units of seminar, and units of research to make a total of 30 units of upper division and graduate level course work.

Courses taken to fulfill prerequisite requirements do not count toward the course requirements. Only courses with a grade of C or better count toward the requirements. Upper division or graduate courses completed with a C- grade or lower do not count towards the student's unit requirement for the master's degree, but do count in computing the GPA. Students must maintain a GPA of at least 3.00 to be in good academic standing.

Full-time students must enroll for at least 12 units per quarter including research, academic, and seminar units. Courses that fulfill any of the program course requirements may not be taken S/U (or P/NP) unless the course is normally graded S/U (or P/NP). Once course requirements are completed, the 12 units per quarter are generally fulfilled with a research class (299) and seminar (290), but students can take additional classes as needed. Per UC regulations, students should not typically enroll in more than 12 units of graduate level courses (200) or more than 16 units of combined undergraduate and graduate level (100, 200, 300) courses per quarter.

Transfer of courses to count toward the MS degree is governed by Graduate Council policy GC2011-03.

Plan II MS

a) Core courses: (8 – 9 units)

All students are required to complete (without substitution) two core courses:
(i) One of the following 2 options in the area of chemical separations and analysis:
- (a) ETX 220, Analysis of Toxicants, 3 units, and (required)
  ETX 220L, Analysis of Toxicants Lab, 2 units
- (b) CHE 219, Spectroscopy of Organic Compounds, 4 units, and (strongly encouraged)
  CHE 219L, Laboratory in Spectroscopy of Organic Compounds, 1 unit

and
(ii) ETX 102A, Environmental Fate of Toxicants, 4 units

b) Elective courses (30 - 31 units)

Elective courses for the Plan II MS are classified into 8 different categories: (1) Statistics: 1 required class, (2) Environmental Chemistry: 3 required classes, (3) Other Chemistry: 1 required class and 1 additional class allowed, (4) Environmental Science/Policy: 1 class allowed, (5) Seminars: 2 units required and up to 3 additional units allowed, (6) Professional Development: 1 class allowed; students must also take 2 workshops or seminars – see Special Requirements, (7) Research: up to 3 units allowed, and (8) Summer Internship or Research: 3 units required. Details for each category are given below.

1) Statistics and Experimental Design (3 – 5 units)

One course in Statistics or Experimental Design selected from the following:

STA100	Applied Statistics for Biological Sciences	4 units
STA101	Advanced Applied Statistics for Biological Sciences	4 units
STA106	Applied Statistical Methods: Analysis of Variance	4 units
STA108	Applied Statistical Methods: Regression Analysis	4 units
STA137	Applied Time Series Analysis	4 units
STA205	Statistical Methods for Research with SAS	4 units
STA223	Biostatistics: Generalized Linear Models	4 units
ECS124	Theory and Practice of Bioinformatics	4 units
PLS205	Experimental Design and Analysis	5 units
PLS206	Applied Multivariate Modeling in Ag & Env Sciences	4 units
VEN215	Sensometrics	3 units

2) Environmental Chemistry (9 -12 units)

At least 3 letter-graded courses (representing at least 9 units) in Environmental Chemistry. At least 2 of these courses (representing at least 6 units) must be at the graduate level. The list of elective courses in Environmental Chemistry is on the Graduate Group's website and is included here as Appendix B.

3) Other Chemistry (3 – 6 units)

1 or 2 graded courses (representing at least 3 units) in the area of Other Chemistry. The list of elective courses in Other Chemistry is on the Graduate Group's website and is included here as Appendix C.

4) Environmental Science/Policy (0 – 4 units)

Up to 4 units (1 course) of an upper-division or graduate lecture course in the area of Environmental Science/Policy. This can be taken P/NP or S/U with approval from the Graduate Advisor and still count toward the unit requirements. The list of elective courses in Environmental Science/Policy is on the Graduate Group's website and is included here as Appendix D.

5) Seminars (2 – 5 units)

Plan II MS students are required to register for and satisfactorily complete Seminar/Colloquium (AGC 290-001) in the Fall and Winter quarters of their first year. Students engaged in research or coursework that prevents their attendance may be exempted from this requirement *with* the approval of the faculty seminar sponsor if arranged within the first 2 weeks of the quarter; if exempted from 290-001, students are expected to register for another seminar series. In addition to the required two seminars, up to an additional 3 units of seminar can be counted toward the required 39 units.

Students in their first year are required to register for AGC 290-002 (Journal Club) in the Spring quarter. Plan II students are welcome, but not required, to take AGC 290-002 (Meet the Faculty seminar) in the Fall quarter.

6) Professional Development (0 – 4 units)

Students can take up to 4 units (1 course) of coursework in Professional Development. Note: if this course is lower division (< 100) it will count toward the 12 units required to be full-time in a given quarter, but will not count towards the 39 total units needed for graduation. Students are also required to take 2 workshops or seminars in Professional Development; see Special Requirements for details.

7) Research (0 – 3 units)

Up to 3 units of laboratory, field, modeling, and/or literature research (299) during the academic year that are completed under the supervision of a Professor approved by the Graduate Advisor. These units can be split over multiple quarters.

8) Summer Internship or Research (3 units)

In the summer following their first year, students are required to register for one or both of the six-week summer sessions to complete either an internship (292) or a research experience (299) in Environmental Chemistry. The summer experience must be at least 90 hours of work (e.g., 15 hours per week for 6 weeks, corresponding to 3 units for one summer session) and be approved by the student's Graduate Advisor. An internship could be with a government agency, non-profit, industry, consulting firm, analytical laboratory, or similar organization. While it is the student's responsibility to find an internship, assistance is available from the Internship and Career Center (http://icc.ucdavis.edu/mpp/) and through the Program Coordinator of AGC. The research experience (299) can involve laboratory, field, modeling, and/or literature work with an approved research advisor. With approval from the Graduate Advisor, this summer experience could be completed during the subsequent Fall quarter.

c) Summary

The Plan II MS requires 8-9 units of Core Courses, 3-5 units of Statistics, 9-12 units of Environmental Chemistry, 3-6 units of Other Chemistry, up to 4 units of Environmental Science/Policy, 3-5 units of Seminar, two Professional Development seminars or workshops, up to 3 units of Research, and a 3-unit Summer Internship or Research experience. In total, the degree requires 39 units total of upper division and graduate level course work.

Courses taken to fulfill prerequisite requirements do not count toward the course requirements. Only courses with a grade of C or better count toward the requirements. Upper division or graduate courses completed with a C- grade or lower do not count towards the student's unit requirement for the master's degree, but do count in computing the GPA. Students must maintain a GPA of at least 3.00 to be in good academic standing.

Full-time students must enroll for at least 12 units per quarter including research, academic, and seminar units. Courses that fulfill any of the program course requirements may not be taken S/U (or P/NP) unless the course is normally graded S/U (or P/NP). Once course requirements are completed, the 12 units per quarter are generally fulfilled with a research class (299) and seminar (290), but students can take additional classes as needed. Per UC

regulations, students cannot enroll in more than 12 units of graduate level courses (200) or more than 16 units of combined undergraduate and graduate level (100, 200, 300) courses per quarter.

Transfer of courses to count toward the MS degree is governed by Graduate Council policy GC2011-03.

4. Special Requirements

The ACS placement examination in general chemistry is not required by AGC. However, to qualify for a TA position in the Chemistry Department students must pass the general chemistry ACS placement exam, which is given at the beginning of the Fall and Winter Quarters.

Plan I

Students who have neither obtained an undergraduate or graduate degree at an approved English-medium institution nor demonstrated strong English language proficiency through the TOEFL or IELTS exam are required to take appropriate English language courses, as described in Graduate Student Course Requirements – English as Second Language (GC-2018-02). Courses taken in satisfaction of this requirement do not count towards the 30 units required for graduation.

MS Plan I students are required to present at the Winter Colloquium (AGC 290-001) in their 2nd year and, if they have not yet graduated, in their 3rd year also.

Plan II

Students who have neither obtained an undergraduate or graduate degree at an approved English-medium institution nor demonstrated strong English language proficiency through the TOEFL or IELTS exam are required to take appropriate English language courses, as described in Graduate Student Course Requirements – English as Second Language (GC-2018-02). Courses taken in satisfaction of this requirement do not count towards the 39 units required for graduation.

Plan II students are required to take at least two Professional Development seminars or workshops on topics such as writing and public speaking. The GradPathways Institute at UC Davis has a listing of options each quarter. These offerings do not generally include unit credit.

English Language Requirement

Students who have not obtained a previous degree at an approved English-medium institution or demonstrated English-language proficiency through an appropriate exam (e.g. TOEFL) are required to complete appropriate English-language courses, as described in the policy *Graduate Student Course Requirements – English as Second Language* (GC2018-02). Courses taken in satisfaction of this requirement do not count towards the units required for graduation.

5. Committees

a) Admissions Committee

Once the completed application, including supporting materials and application fee, has been received, the application will be submitted to the Admissions Committee. Based on a holistic review of the application, a recommendation is made to accept or decline the application for admission. That recommendation is forwarded to the Dean of Graduate Studies for final approval of admission. Formal notification of admissions decisions will be sent by Graduate Studies.

b) Course Guidance Committee

Plan I
This committee consists of the student's Major Professor (if identified) and their Graduate Advisor. Students are required to meet with their committee in the Fall quarter to establish a Plan of Study. If the Major Professor has not been identified by the Fall quarter, then the student must meet with their Graduate Advisor in the Fall and have a meeting with the full Guidance Committee (i.e., Major Professor and Graduate Advisor) by the end of Spring Quarter of the first year. The full committee will design a written Plan of Study based upon the student's needs and interests that is signed by all three parties. Minor changes to the plan can be done in person with their Graduate Advisor and with email agreement by the Major Professor. Major changes to the plan require a Guidance Committee meeting and unanimous approval.

Plan II
Each student will meet with their Graduate Advisor - either before the beginning of Fall quarter or early in the quarter - to establish a Plan of Study based upon the student's needs and interests. This plan should be signed by both the Advisor and student. Changes to the plan require approval by the student's Graduate Advisor.

c) Thesis and Examination Committees

Plan I (Thesis Committee)
The MS student, in conjunction with their Major Professor and Graduate Advisor, shall recommend a Thesis Committee consisting of the Major Professor (as Chair) and at least two additional members to Graduate Studies. The Chair and at least one of the other committee members must be members of the Agricultural & Environmental Chemistry Graduate Group. This committee will evaluate whether the thesis has been satisfactorily completed. Thesis committee nominations are submitted to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy.

Plan II (Examination Committee)
The Examination Committee is composed of at least 2 faculty members, at least one of whom must be in the Agricultural & Environmental Chemistry Graduate Group. The committee will write exam questions, and solicit exam questions from other instructors, to cover material covered in the Core and Elective Courses.

6. Advising Structure and Mentoring

Plan I (Thesis)
The Major Professor is the faculty member who supervises a Plan I MS student's research and thesis. Mentoring Guidelines are in the Graduate Student Handbook, which is on the Group's web site, agchem.ucdavis.edu. The Graduate Advisor is a resource for information on academic requirements, policies and procedures, and has signatory authority. The Graduate Program Coordinator (staff member) assists students with registration information, finding TA appointments, and understanding general university policies.

Plan II (Comprehensive Exam)
The Graduate Advisor is a resource for information on academic requirements, policies and procedures. The Graduate Program Coordinator (staff member) assists students with registration information and understanding general university policies.

7. Advancement to Candidacy

Plan I (Thesis)
MS Plan I students are expected to advance to candidacy by the end of their 3rd quarter.

Every student must file an official application for Candidacy for the Degree of Master of Science and pay the Candidacy Fee after completing one-half of their course requirements and at least one quarter before completing all degree requirements; this is typically the end of the 3rd quarter. The Candidacy for the Degree of Master form can be found online at: http://www.gradstudies.ucdavis.edu/forms/. A completed form includes a list of courses the student will take to complete the degree requirements. If changes must be made to the student's course plan after they have advanced to candidacy, the Graduate Advisor must recommend these changes to Graduate Studies. Students must have their Graduate Advisor and committee Chair (i.e., Major Professor) sign the candidacy form before it can be submitted to Graduate Studies. If the candidacy is approved, the Office of Graduate Studies will send a copy to: the student, the Graduate Program Coordinator, and the Thesis Committee Chair. If the Office of Graduate Studies determines that a student is not eligible for advancement, the program and the student will be told the reasons for the application's deferral. Some reasons for deferral include grade point average below 3.0, outstanding "I" grades in required courses, or insufficient units.

Plan II (Comprehensive Exam)
MS Plan II students are expected to advance to candidacy at the end of their 2nd quarter.

Every student must file an official application for Candidacy for the Degree of Master of Science and pay the Candidacy Fee after completing one-half of their course requirements and at least one quarter before completing all degree requirements; this is typically the end of the 2nd quarter. The Candidacy for the Degree of Master form can be found online at: http://www.gradstudies.ucdavis.edu/forms/. A completed form includes a list of courses the student will take to complete degree requirements. If changes must be made to the student's course plan after they have advanced to candidacy, the Graduate Advisor must recommend these changes to Graduate Studies. Students must have their Graduate Advisor sign the candidacy form before it can be submitted to Graduate Studies. If the candidacy is approved,

the Office of Graduate Studies will send a copy to the student and the Graduate Program Coordinator. If the Office of Graduate Studies determines that a student is not eligible for advancement, the program and the student will be told the reasons for the application's deferral. Some reasons for deferral include a grade point average below 3.0, outstanding "I" grades in required courses, or insufficient units.

8. Thesis Requirements and Comprehensive Exam

Plan I (Thesis)

Thesis committee meetings. The student and Thesis Committee should meet at least annually to discuss progress and any changes in research objectives.

Thesis: Research for the Master's thesis is to be carried out under the supervision of the Major Professor and must represent an original contribution to knowledge in the field. The thesis research must be conducted while the student is enrolled in the program. The thesis is submitted to the thesis committee at least one month before the student plans to make requested revisions. Committee members must provide feedback within four weeks of receipt of the thesis, per the *Policy on Service on Advanced Degree Committees* (GC1998-01). This does not include summer months, for committee members having nine month appointments. Once returned, the student will make necessary revisions and return the thesis to the committee for approval or additional revisions. All committee members must approve the thesis and sign the title page before the thesis is submitted to Graduate Studies for final approval. Should the committee determine that the thesis is unacceptable, even with substantial revisions, the program may recommend to the Dean of Graduate Studies that the student be disqualified from the program.

The thesis must be filed in a quarter in which the student is registered or on filing fee. Instructions on preparation of the thesis and a schedule of dates for filing the thesis in final form are available on the Graduate Studies web site. A student must have a GPA of 3.0 for the M.S. degree to be awarded.

Exit Seminar: M.S. Plan I students are required to present a 50-minute exit seminar. The student needs to advertise the Exit Seminar to faculty and students in the group at least 3 weeks prior to the seminar date.

Plan II (Comprehensive Examination)

The Comprehensive Examination is a required, proctored, closed book, written exam of no more than five hours that is based on the two core courses and other coursework taken by students sitting the exam. Questions are written by the Examination Committee, who will also solicit questions from faculty who taught courses taken by the students. Some questions on the exam (e.g., those covering core course material) will be answered by all students, while other questions will allow students to choose from options that cover a range of classes. Questions will be graded by the Examination Committee and by the other faculty who wrote questions. A grade of 70% or higher is passing.

Timing. Students must advance to candidacy before taking the Comprehensive Exam and must be registered or in current filing fee status when they take the exam. Exams are given twice a year: once in the Spring quarter and once in the summer. All students are expected

to take the exam in the Spring of their first year.

Outcome. Students who fail the Spring exam may take it one additional time if the Graduate Advisor concurs; this second exam will generally occur in the summer following the Spring exam. The second exam will have the same format and timing as the first exam, but different questions. Students who fail two exams will be recommended for disqualification from further graduate work in the program to the Dean of Graduate Studies.

Once passed, the Master's Report Form is signed by the Chair of the Exam Committee and then passed on to the student's Graduate Advisor. Once the student has completed the Summer Internship or Research experience, the Graduate Advisor will verify the student has completed all requirements, sign the Master's Report Form and forward it to the Office of Graduate Studies. The deadlines for submitting the Master's Report Form are listed each quarter in the campus General Catalog (available online at the website of the Office of the Registrar). A candidate must be a registered student or in Filing Fee status at the time the program submits the form. The program must file the report with Graduate Studies within one week of the end of the quarter in which the student's degree will be conferred. Students must finish all requirements, including the Summer Internship or Research experience, before their degree will be awarded.

9. Normative Time to Degree

Plan I (Thesis)
Students are expected to finish their degrees within 7 quarters of enrollment. Students should advance to Candidacy at the end of their 3rd academic quarter and then complete their degree within the next four quarters.

Plan II (Comprehensive Exam)
Students are expected to finish their degrees within 1 calendar year of enrollment, including at least one summer session. Students should advance to Candidacy in their 2nd academic quarter (Winter), complete their coursework and take the Comprehensive Exam in Spring, and fulfill the Internship/Research requirement over the summer to complete their degree.

10. Typical MS Time Line and Sequence of Events

Plan I (Thesis)

	Fall	Winter	Spring	Summer
Year 1	ETX 200 & 220L, Analysis of toxicants	STA 1xx or other approved statistics	200-level course	Research
	CHE 233, Physical-Organic Chemistry	200-level course	200-level course	
	XXX 299, Research	XXX 299, Research	XXX 299, Research	
	AGC 290-001, Research seminar	AGC 290-001, Winter Colloquium	AGC 290-002, Journal Club	
	AGC 290-002, Meet the Faculty Seminar	AGC 290-002, Presenting a Seminar	[Advance to MS Candidacy]	
Year 2	XXX 299, Research	XXX 299, Research	XXX 299, Research	Research
	AGC 290-001, Research seminar	AGC 290-001, Winter Colloquium		

Year 3	XXX 299, Research			
	AGC 290-001, Research seminar			
	Exit Seminar			
	Complete Thesis			

Deficiencies in prerequisite coursework at the time of enrollment will likely delay this time line.

Plan II (Comprehensive Exam)

	Fall	Winter	Spring	Summer
Year 1	ETX 200 & 220L, Analysis of toxicants	ETX 102A, Environmental Fate of Toxicants	STA 1xx or other approved statistics	XXX 292, Internship or XXX 299, Research
	CHE 233, Physical-Organic Chemistry	200-level course	100-level course	
	100-level course	200-level course	200-level course	
	AGC 290-001, Research seminar	AGC 290-001, Winter Colloquium	AGC 290-002, Journal Club	
	AGC 290-002, Meet the Faculty Seminar	GradPathways Professional Development Workshop	GradPathways Professional Development Workshop	
		[Advance to MS Candidacy]	[Take Comprehensive Exam]	

Three detailed, possible MS Plan II course plans are shown in Appendix E. Deficiencies in prerequisite coursework at the time of enrollment will likely delay these time lines.

11. Sources of Funding

Plan I (Thesis)
MS Plan I students are typically funded by the group for the first quarter of enrollment. After this, students are generally funded through a combination of GSR positions with their Major Professor and Teaching Assistantships (although MS students are not required to be a TA). Students are also encouraged to pursue their own funding through internal and external fellowships.

Plan II (Comprehensive Exam)
MS Plan II students are expected to provide their own funding.

12. PELP, In Absentia, and Filing Fee Status

Information about PELP (Planned Educational Leave), In Absentia (reduced fees when researching out of state), and Filing Fee status can be found under the Policies link on the Graduate Studies website: http://www.grad.ucdavis.edu/policies/.

Ph.D. Degree Requirements

1. **Admissions requirements**
   Consideration for admission to the PhD program requires a bachelor's degree, three letters of recommendation, official transcripts, TOEFL or IELTS score (if applicable) and an Office of Graduate Studies online application with fee by the stated admission deadline. An MS degree is not required for admission to the PhD program. No GRE tests are required. The decision to recommend admission to the Dean of Graduate Studies will be made by the Program Admissions Committee on the basis of available space and the competitiveness of applicants compared to the eligible pool.

   a) **Prerequisites.** A degree in chemistry is not required, but significant coursework in chemistry is required. Applicants are expected to have scored a B or better in the equivalent of the following UC Davis courses:

      i) One year of organic chemistry (including laboratory), equivalent to UC Davis Chemistry courses CHE 118 A,B,C or CHE 128 A,B,C
      ii) Two quarters (or one semester) of physical chemistry (including laboratory), equivalent to CHE 107 A,B or Chemistry 110 A,B,C
      iii) Two additional upper division courses in chemistry (e.g., inorganic, biochemistry, analytical, food, pharmaceutical, or environmental)

      Applicants without at least one semester (or two quarters) of organic chemistry will not be admitted. Applicants missing more than two semesters of the other upper division courses in chemistry will not be admitted.

   b) **English-language requirement.** Applicants must meet the UC Davis minimum scores on the TOEFL or IELTS, which are specified by Grad Studies policy GS2014-04.

   c) **Deficiencies and Placement examinations.**

      Students who are missing a prerequisite class, or who took the prerequisite but earned below a B grade, have two options for each missing class:

      (1) The first option is to take the class as part of their PhD work and earn a grade of B or better. Coursework deficiencies should be made up by the end of the first academic year. Courses taken to fulfill the prerequisite requirement do not count toward the PhD Course Requirements.

      (2) The second option is to pass the corresponding American Chemical Society (ACS) placement examination, which is available for organic, inorganic, and physical chemistry. Examinations are given before Fall quarter instruction begins; the Program Coordinator provides incoming students with exact dates each year. A passing grade is scoring at or above the 60th percentile. A student who does not pass a placement exam can retake the exam in Winter quarter or take the class (option 1). If a student does not score above the 60th percentile on the 2nd attempt, they must take the class(es) corresponding to the portions of the exam where they scored below the 60th percentile.

      Students without deficiencies. Students who have taken all of the prerequisite classes,

and earned a B grade or better in each one, do not need to take the placement exams.

2. Dissertation Plan

Plan B. PhD students have a Dissertation Committee of at least three members and must complete an Exit Seminar, which shall be verified by the Major Professor. There is no final oral examination.

3. Course Requirements (33 – 44 units)

a) Core courses (7 – 8 units)

All students are required to complete (without substitution) two core courses:
(i) One of the following 3 options in the area of chemical separations and analysis:
(a) ETX 220, Analysis of Toxicants, 3 units, and (required)
ETX 220L, Analysis of Toxicants Lab, 2 units
(b) CHE 219, Spectroscopy of Organic Compounds, 4 units, and (strongly encouraged)
CHE 219L, Laboratory in Spectroscopy of Organic Compounds, 1 unit
(c) VEN 223, Instrumental Analysis of Must and Wine, 4 units
and
(ii) One of the following 2 options in chemical reaction mechanisms:
(a) CHE 233, Physical-Organic Chemistry, 3 units
(b) CHE 226, Principles of Transition Metal Chemistry, 3 units.

b) Elective courses (15 - 21 units of Statistics and Specialization, plus an additional 11 - 15 units of seminar (290))

To fulfill the PhD Elective requirements, students must take 1 course in Statistics and Experimental Design, 4 Specialization courses (at least 3 that are graduate level), and 11 – 15 units of seminar. Details on these requirements are listed below.

1) Statistics and Experimental Design (3 – 5 units)

One course in Statistics or Experimental Design selected from the following:

STA100	Applied Statistics for Biological Sciences	4 units
STA101	Advanced Applied Statistics for Biological Sciences	4 units
STA106	Applied Statistical Methods: Analysis of Variance	4 units
STA108	Applied Statistical Methods: Regression Analysis	4 units
STA137	Applied Time Series Analysis	4 units
STA205	Statistical Methods for Research with SAS	4 units
STA223	Biostatistics: Generalized Linear Models	4 units
ECS124	Theory and Practice of Bioinformatics	4 units
PLS205	Experimental Design and Analysis	5 units
PLS206	Applied Multivariate Modeling in Ag & Env Sciences	4 units
VEN215	Sensometrics	3 units

2) Specialization (12 – 16 units)

PhD students are required to register for, and complete, 3 graded graduate lecture courses,

with at least 3 having a strong chemistry emphasis. At least 3 of the 4 courses must be at the graduate level; 1 of the courses may be an upper-division course with approval by the Graduate Advisor. A list of suggested elective courses is available on the Group's web site and is included here as Appendix A. Students are encouraged to recommend to the Chair and Educational Policy Committee other existing courses that could serve as specialization courses.

3) Seminar (11 - 15 units)

Students in their first year are required to register for AGC 290-002 each quarter. This corresponds to the Meet the Faculty Seminar in the Fall, the Mechanics of Presenting a Seminar course in Winter, and Journal Club in Spring.

In addition, during the first year and every subsequent year, all students are required to attend, participate in, and satisfactorily complete Seminar/Colloquium (AGC 290-001) each quarter that it is offered (typically the Fall and Winter quarters) and they are registered. Students engaged in research or coursework that prevents their attendance may be exempted from this requirement with the approval of the faculty seminar sponsor if arranged within the first 2 weeks of the quarter; if exempted from 290-001, students are expected to register for another seminar series.

c) Summary

The PhD degree requires a minimum of 7-8 units of Core Courses, 15-21 units of Elective Courses (not including seminar), and 11-15 units of seminar to make a total of at least 33 units of upper division and graduate level course work. At least 16 of the 33 units must be at the graduate level; 290 and 299 do not count towards these 16 units. Courses taken to fulfill the prerequisite requirement do not count toward the Course Requirements.

Only courses with a grade of C or better count toward the requirements. Upper division or graduate courses completed with a C- grade or lower do not count towards the student's unit requirement for the PhD degree, but do count in computing the GPA. Students must maintain a GPA of at least 3.00 to be in good academic standing.

Full-time students must enroll for 12 units per quarter including research, academic and seminar units. Courses that fulfill any of the program course requirements may not be taken S/U (or P/NP) unless the course is normally graded S/U (or P/NP). Once course requirements are completed, the 12 units per quarter are generally fulfilled with a research class (299) and seminar, but students can take additional classes as needed. Per UC regulations, students should not ordinarily enroll in more than 12 units of graduate level courses (200) or more than 16 units of combined undergraduate and graduate level (100, 200, 300) courses per quarter.

Classes that were taken prior to enrollment in the PhD program (e.g., as part of a prior graduate degree) can be used to waive required coursework and the accompanying units if they meet these five requirements: (i) the class is essentially the same as a Core Course or is equivalent to a course that would be taken as an Elective Course, (ii) the class was not taken to fulfill an undergraduate degree requirement, (iii) the student received a B grade or better in the class, (iv) the class was taken within 7 years of starting in the Agricultural & Environmental Chemistry PhD program, and (v) the request is approved by the student's

Graduate Advisor and the Chair of the Graduate Group. If the first four requirements above are met then the student submits a written request to their Graduate Advisor explaining which qualified course(s) the student has taken and which current requirements (courses and units) they are seeking to waive. The request will then be considered by the Advisor and Chair. There is no limit to the number of courses or units that can be waived, but students are expected to demonstrate strong knowledge of required coursework, including for waived courses, as part of their Qualifying Exam.

4. Special Requirements

a) English Language Proficiency

Students who have neither obtained an undergraduate or graduate degree at an approved English-medium institution nor demonstrated strong English language proficiency through the TOEFL or IELTS exam are required to take appropriate English language courses, as described in Graduate Student Course Requirements – English as Second Language (GC-2018-02). Courses taken in satisfaction of this requirement do not count towards the 30 units required for graduation.

b) Seminar Presentations

PhD students are required to present at least 3 talks in the Winter Colloquium (AGC 290-001), one each in years 2, 3, and 4.

c) Teaching Experience

PhD students must be a Teaching Assistant of a 3-unit course or the equivalent approved by the Coursework Guidance Committee. In order to TA for the Chemistry Department, students must pass the general chemistry ACS placement exam, which is given at the beginning of the Fall and Winter Quarters. All TAs must complete mandatory TA training as required by campus guidelines; see https://cee.ucdavis.edu/tao.

5. Committees

a) Admissions Committee

Once the completed application, including supporting materials and application fee, has been received, the application will be submitted to the Admissions Committee. Based on a holistic review of the entire application, a recommendation is made to accept or decline the application for admission. That recommendation is forwarded to the Dean of Graduate Studies for final approval of admission. Formal notification of admissions decisions will be sent by Graduate Studies.

b) Course Guidance Committee

This committee consists of the student's Major Professor (if identified) and the Graduate Advisor. Students are required to meet with their committee in their first Fall quarter to establish a Plan of Study. If the Major Professor has not been identified by the Fall quarter, then the student must meet with their Graduate Advisor in the Fall and have a meeting with

the full Guidance Committee (i.e., Major Professor and Graduate Advisor) by the end of Spring Quarter of the first year. The full committee will design a written Plan of Study based upon the student's needs and interests that is signed by all three parties. Minor changes to the plan can be done in person with the Graduate Advisor and with email agreement by the Major Professor. Major changes to the plan require a Guidance Committee meeting and unanimous approval.

c) Qualifying Exam Committee

The Ph.D. student in conjunction with their Course Guidance Committee will nominate a Qualifying Exam Committee to Graduate Studies. The committee will consist of five members: three (or more) members from the graduate group and at least one member from outside the group. The Major Professor cannot serve on the Qualifying Exam Committee. The Qualifying Exam Committee conducts the exam and submits results to the Office of Graduate Studies.

d) Dissertation Committee

The PhD student, in conjunction with their Major Professor, nominates a Dissertation Committee consisting of the Major Professor (as Chair) and at least two additional members to Graduate Studies. In addition to the Chair, at least one of the other committee members must be a member of the Agricultural & Environmental Chemistry Graduate Group. Requirements for committee members are detailed in Graduate Council Policy GC1998-01. The composition of the dissertation committee is entered on the Advancement to Candidacy Form and submitted to Graduate Studies for formal appointment in accordance with Graduate Council policy.

The role of the Dissertation Committee is to advise the doctoral student on the research topic and methods, and evaluate whether the thesis has been satisfactorily completed. The Committee Chair (i.e., the Major Professor) should determine the desires of the individual members regarding assistance with the research and dissertation review at the time the dissertation committee is constituted. Students are expected to meet with the Chair of their dissertation committee regularly. Dissertation committee members are expected to read and comment on a dissertation within four weeks from its submission. This time limit policy does not apply to summer periods for faculty holding nine-month appointments. The student and faculty will coordinate a timeline for the student to present the thesis to the dissertation committee. This timeline must allow all dissertation committee members enough time to fulfill their responsibilities within the four-week deadline.

6. Advising Structure and Mentoring

The Major Professor is the faculty member who supervises the student's research and dissertation. Mentoring Guidelines are in the Graduate Student Handbook, which is on the Group's web site, agchem.ucdavis.edu. The Graduate Advisor is a resource for information on academic requirements, policies and procedures and has signatory authority. The Graduate Program Coordinator (staff member) assists students with registration information, finding TA appointments, and understanding general university policies.

7. Advancement to Candidacy

PhD students are expected to advance to candidacy by their 7th quarter.

Before advancing to candidacy for a doctoral degree, a student must have satisfied all requirements set by the graduate group, must have maintained a minimum GPA of 3.0 in all course work, and must have passed the Qualifying Examination. After fulfilling these requirements, the student must file an official application for Candidacy for the Degree of Doctor of Philosophy with the Office of Graduate Studies and pay the Candidacy Fee. On this form the student also nominates their Dissertation Committee. Refer to the Graduate Council website for additional details regarding the Qualifying Examination at http://gradstudies.ucdavis.edu/gradcouncil/policiesall.html. The Candidacy form is available at https://grad.ucdavis.edu/current-students/forms-information.

8. Qualifying Examination and Dissertation Requirements

a) Qualifying Examination

1) General Information

Students must complete all course requirements before taking their Qualifying Examination (QE). The qualifying exam should be taken by the 7th quarter and no later than the end of the 9th quarter after admission to the Ph.D. program.

The primary purpose of the Qualifying Examination is to validate that the student is academically qualified to conceptualize a research topic, undertake scholarly research and successfully produce the dissertation required for a doctoral degree. The QE must evaluate the student's command of the field, ensuring that the student has both breadth and depth of knowledge, and must not focus solely on the proposed dissertation research. In addition, the QE provides an opportunity for the committee to provide important guidance to the student regarding his or her chosen research topic.

The Qualifying Examination will consist of a written prospectus and an oral examination.

2) Written Portion of the Exam – Dissertation Prospectus

The written portion of the QE consists of a research proposal called the Dissertation Prospectus. The Prospectus must be provided to members of the qualifying examination committee at least 10 days before the oral portion of the qualifying exam.

The Prospectus is an independently prepared research proposal of no more than 10 pages that describes the background of the research area (including a summary of previous studies), the student's dissertation-specific research aims, hypotheses, experimental approach, and progress to date. A title page and references are not included in the 10-page limit. Concepts within the research proposal can be discussed with others, such as the student's Major Professor, and with peers. As the proposal will serve as evidence of the student's proficiency in scientific writing, the text of the Prospectus should be solely the student's work, but editorial assistance and feedback on the Prospectus is allowed . The qualifying exam committee will be responsible for assessing that the student's writing proficiency is satisfactory before advancement to candidacy. Furthermore, the Prospectus will provide information that will likely be discussed during the oral exam.

3) Oral Portion of the Exam
The oral portion of the qualifying exam will be 2-3 hours in length and is intended to demonstrate the student's critical thinking ability, powers of imagination and synthesis, and broad knowledge of the field of study. The Oral Exam generally has two portions. In the first portion the student presents their research proposal while the committee asks questions that are generally designed to test the student's knowledge of the field, clarify points, and explore components of the proposed research. The student should prepare a 20 - 30 min presentation for this portion of the exam; with Committee questions this portion generally takes 90 min. In the second portion of the exam, the Committee will generally ask a wider range of questions that includes material from coursework, from the general field of study, and from the Prospectus.

The committee will evaluate the student's general qualifications for a respected position as an educator or leader as well as the student's preparation in a special area of study. This evaluation is based upon relevant portions of the student's previous academic record, performance in the examination, and the student's potential for scholarly research as indicated during the examination.

A student should not bring refreshments for the Qualifying Exam Committee, but is welcome to bring their own food and drink.

4) Outcome of the Exam
Immediately after the Oral Exam, the Committee will discuss the student's performance on the two portions of the QE to decide on an outcome. The outcome of the exam must be communicated to Graduate Studies within 72 hours. There are three possible outcomes:

- Pass. In this case no conditions may be appended to this decision.
- Not Pass. In this case the Chair's report should specify, in writing, exactly how the student needs to address any deficiencies identified during the Exam. This could include rewriting the Prospectus, retaking all or part of the Oral Exam, and/or additional requirements (e.g., coursework). The exact requirements, and the timeline for their completion, in order to achieve a Pass needs to be communicated to Graduate Studies and the student within 72 hours.
- Fail.

After the Committee makes its decision, the Chair will discuss the outcome with the student. If the outcome is not unanimous (i.e., a split decision), the votes for each outcome are reported and sent to the Office of Graduate Studies along with statements from the majority and minority opinions. If a unanimous decision takes the form of Not Pass or Fail, the Chair of the QE Committee must include in its report a specific statement, agreed to by all members of the committee, explaining its decision and must inform the student of its decision. A student receiving a Not Pass may attempt the QE one additional time; the QE report must list the specific conditions and timing for the second exam. After a second examination, a vote of Not Pass is not an option: the decision must be Pass or Fail. Only one retake of the qualifying examination is allowed. Should the student receive a Fail on the first or second attempt at the exam, the student will be recommended for disqualification from the program to the Dean of Graduate Studies.

b) Dissertation

1) Exit Seminar
The dissertation follows Plan B with a required 50-minute exit seminar. Satisfaction of this requirement must be verified by the Dissertation Committee Chair. The Exit Seminar is a formal public presentation of the student's research before the program faculty and students, either as part of the AGC seminar series or as a stand-alone talk. The Dissertation Committee will not sign the Dissertation until after the exit seminar has taken place. The student needs to advertise the Exit Seminar to faculty and students in the group at least 3 weeks prior to the seminar date.

2) Dissertation: General Requirements
Filing of a PhD dissertation with the Office of Graduate Studies is normally the last requirement satisfied by the candidate. The deadlines for completing this requirement are listed at https://grad.ucdavis.edu/resources/graduate-student-resources/academic-information-and-services/dates-and-deadlines). A candidate must be a registered student or in Filing Fee status at the time of filing a dissertation, with the exception of the summer period between the end of the Spring Quarter and the beginning of Fall Quarter. The PhD Dissertation will be prepared, submitted and filed according to regulations instituted by the Office of Graduate Studies http://gradstudies.ucdavis.edu/students/filing.html. Satisfaction of this requirement must be verified by the Dissertation Committee Chair.

3) Dissertation
PhD candidates will complete a written dissertation that represents an original, significant, and publishable contribution to the scientific body of knowledge. The dissertation is carried out under the supervision of a member of the graduate group while the student is enrolled in the program. The chair of the dissertation committee must be a member of the group and must be immediately involved with the planning and execution of the experimental work done to formulate the dissertation. The Major Professor's laboratory is the setting for most of the student's research activities, unless an alternative site and immediate supervisor are approved in advance by the Executive Committee.

Students should meet at least once a year with their dissertation committee. The dissertation must be submitted to each member of the dissertation committee at least one month before the student expects to make requested revisions; committee members are expected to respond within 4 weeks, not including summer months for nine month faculty. Informing committee members of progress as writing proceeds helps the members to plan to read the dissertation and provide feedback within this time frame. The dissertation must be approved and signed by the dissertation committee before it is submitted to Graduate Studies for final approval.

9. Normative Time to Degree

Students should advance to candidacy in their 7th academic quarter, but no later than the 9th quarter. Students with a prior MS degree in a chemistry-related field are expected to advance to candidacy before this. After advancement to candidacy, students should spend approximately 9 quarters completing their research and finishing their degrees. Overall, students are expected to finish their degrees within 6 years of starting in the program.

10. Typical PhD Time Line and Sequence of Events

	Fall	Winter	Spring	Summer
Year 1	ETX 200 & 220L, Analysis of toxicants	STA 1xx or other approved statistics	200-level course	Research
	CHE 233, Physical-Organic Chemistry	200-level course	200-level course	
	XXX 299, Research	XXX 299, Research	XXX 299, Research	
	AGC 290-001, Research seminar	AGC 290-001, Winter Colloquium	AGC 290-002, Journal Club	
	AGC 290-002, Meet the Faculty Seminar	AGC 290-002, Presenting a Seminar		
Year 2	XXX 299, Research	XXX 299, Research	XXX 299, Research	Research
	200-level course	AGC 290-001, Winter Colloquium (including presentation)		
	AGC 290-001, Research seminar			
	[Qualifying Exam Preparation]	[Qualifying Exam Preparation]	[Qualifying Exam] [Advancement to PhD Candidacy]	
Years 3 - 6	XXX 299, Research	XXX 299, Research	XXX 299, Research	Research
	AGC 290-001, Research seminar	AGC 290-001, Winter Colloquium (including presentations in years 3 and 4)		
	Exit Seminar			
	Complete Dissertation			

Deficiencies in pre-requisite coursework at the time of enrollment will likely delay this time line.

11. Sources of Funding

PhD students are typically funded by the group for the first two quarters of enrollment. After this, PhD students are generally funded through a combination of GSR positions with their Major Professor and Teaching Assistantships. Students are also encouraged to pursue their own funding through internal and external fellowships.

12. PELP, In Absentia, and Filing Fee Status

Information about PELP (Planned Educational Leave), In Absentia (reduced fees when researching out of state), and Filing Fee status can be found on the Graduate Studies web site; https://grad.ucdavis.edu/current-students/forms-information.

13. Leaving the Program Prior to Completion of the PhD Requirements

Should a student leave the program prior to completing the requirements for the PhD, they may still be eligible to receive a Master's degree, either Plan I or Plan II, if they have fulfilled all of the MS requirements (see Master's section in this document). To change degree programs, students need to file a Change of Degree Objective form, which is available from the Registrar's Office web site: http://registrar.ucdavis.edu/local_resources/forms/D065-graduate-major-degree-change.pdf.

Appendix A: Elective Courses for MS Plan I and PhD

Students are encouraged to suggest new Elective Courses. All requests to add an Elective Course must be approved by the AGC Educational Policy Committee.

Course	Units	Title	Quarter Offered
ATM 160	4	Introduction to Atmospheric Chemistry	Alternate Winter
ATM 260	3	Atmospheric Chemistry	Alternate Spring
BPH 200A/B	3	Current Techniques in Biophysics	Winter/Spring
CHE 100	3	Environmental Water Chemistry	Winter
CHE 205	3	Symmetry, Spectroscopy, and Structure	Winter
CHE 216	3	Magnetic Resonance Spectroscopy	Alternate Spring
CHE 217	3	X-Ray Structure Determination	Spring
CHE 219*	4	Spectroscopy of Organic Compounds	Winter
CHE 219L*	1	Laboratory in Spectroscopy of Organic Compounds	Winter
CHE 228A	3	Bio-inorganic Chemistry	Every 3rd Winter
CHE 237	3	Bio-organic Chemistry	Irregular Winter
CHE 240	3	Advanced Analytical Chemistry	Fall
CHE 241C	3	Special Topics in Analytical Chemistry: Mass Spec	Winter
CHE 245	3	Mechanistic Enzymology	Spring
ECH 254	4	Colloid and Surface Phenomena	Spring
ECH 265	3	Emulsions, Microemulsions and Biolayers	Winter
ECI 240	4	Water Quality	Winter
ECI 241	4	Envtl Reactive Chemical Transport Modeling	Alternate Spring
ECI 242	4	Air Quality	Alternate Fall
ECI 243A	4	Water and Waste Treatment	Fall
ECI 245A	4	Applied Environmental Chemistry: Inorganic	Alternate Spring
ECI 245B	4	Applied Environmental Chemistry: Organic	Alternate Spring
ECI 247	4	Aerosols	Alternate Fall
ECI 247L	4	Aerosols Laboratory	Alternate Spring
ECS 124	4	Theory and Practice of Bioinformatics	Fall
ETX 102A	4	Environmental Fate of Toxicants	Winter
ETX 102B	5	Quantitative Analysis of Environmental Toxicants	Spring
ETX 111	3	Introduction to Mass Spectrometry	Winter
ETX 131	3	Environmental Toxicology of Air Pollutants	Fall
ETX 203	4	Environmental Toxicants	Alternate Spring
ETX 220*	3	Analysis of Toxicants	Fall
ETX 220L*	2	Analysis of Toxicants Laboratory	Fall
ETX 228	3	GC/Mass Spectrometry of Toxic Chemicals	Alternate Winter
ETX 240	3	Ecotoxicology	Alternate Spring
FPS 150	3	Polymer Syntheses and Reactions	Spring
FPS 161	3	Structure and Properties of Fibers	Fall
FPS 161L	1	Textile Chemical Analysis Laboratory	Fall
FPS 250A	3	Special Topics: Polymer Chemistry	Spring
FPS 250B	3	Special Topics: Polymer Physics	Spring

FPS 250E	3	Special Topics: Functional Materials	Fall
FST 201	4	Food Chemistry and Biochemistry	Fall
FST 202	4	Physical Chemistry of Foods	Spring
FST 203	4	Food Processing	Winter
FST 211	3	Lipids: Chemistry and Nutrition	Winter
FST 213	3	Flavor Chemistry of Foods and Beverages	Alternate Spring
GEL 132	3	Introductory Inorganic Geochemistry	Alternate Fall
GEL 146	3	Radiogenic Isotope Geochem and Cosmochemistry	Alternate Fall
GEL 148	3	Stable Isotopes and Geochemical Tracers	Irregular Spring
GEL 227	4	Stable Isotope Biogeochemistry	Alternate Fall
HYD 134	6	Aqueous Geochemistry	Spring
HYD 146	4	Hydrogeology and Contaminant Transport	Winter
HYD 210	3	Vadose Modeling and Characterization	Irregular Spring
MIC 263	3	Principles of Protein-Nucleic Acid Interactions	Irregular Spring
PTX 201	5	Principles of Pharmacology & Toxicology I	Fall
PTX 202	4	Principles of Pharmacology & Toxicology II	Winter
SSC 102	3	Environmental Soil Chemistry	Winter
SSC 111	4	Soil Microbiology	Alternate Winter
SSC 202	4	Topics in Advanced Soil Chemistry	Winter
SSC 211	3	Advanced Soil Microbiology	Alternate Fall
SSC 219	4	Ecosystem Biogeochemistry	Alternate Spring
SSC 222	3	Global Carbon Cycle	Alternate Winter
VEN 210	3	Grape Development and Composition	Alternate Spring
VEN 219	3	Natural Products of Wine	Alternate Winter
VEN 223*	4	Instrumental Analysis of Musts and Wines	Irregular
VMB 253	2	Metabolism of Toxicants and Drugs	Alternate Winter

*May be taken as an Elective Course if not taken as a Core Course.

Appendix B: Elective Courses in Environmental Chemistry for MS Plan II

Course	Units	Title	Quarter Offered
ATM 160	4	Introduction to Atmospheric Chemistry	Alternate Winter
ATM 260	3	Atmospheric Chemistry	Alternate Spring
CHE 100	3	Environmental Water Chemistry	Winter
ECI 240	4	Water Quality	Winter
ECI 241	4	Envtl Reactive Chemical Transport Modeling	Alternate Spring
ECI 242	4	Air Quality	Alternate Fall
ECI 243A	4	Water and Waste Treatment	Fall
ECI 245A	4	Applied Environmental Chemistry: Inorganic	Alternate Spring
ECI 245B	4	Applied Environmental Chemistry: Organic	Alternate Spring
ECI 247	4	Aerosols	Alternate Fall
ECI 247L	4	Aerosols Laboratory	Alternate Fall
ETX 203	4	Environmental Toxicants	Alternate Spring
HYD 134	6	Aqueous Geochemistry	Spring
SSC 102	3	Environmental Soil Chemistry	Winter
SSC 202	4	Topics in Advanced Soil Chemistry	Winter
SSC 219	4	Ecosystem Biogeochemistry	Alternate Spring
SSC 222	3	Global Carbon Cycle	Alternate Winter

Appendix C: Elective Courses in Other Chemistry for MS Plan II

Course	Units	Title	Quarter Offered
CHE 205	3	Symmetry, Spectroscopy, and Structure	Winter
CHE 212	3	Chemical Dynamics	Alternate Winter
CHE 216	3	Magnetic Resonance Spectroscopy	Alternate Spring
CHE 217	3	X-ray Structure Determination	Spring
CHE 219*	4	Spectroscopy of Organic Compounds	Winter
CHE 219L*	1	Laboratory in Spectroscopy of Organic Compounds	Winter
CHE 226	3	Principles of Transition Metal Chemistry	Fall
CHE 233	3	Physical-Organic Chemistry	Fall
CHE 240	3	Advanced Analytical Chemistry	Fall
CHE 241C	3	Special Topics in Analytical Chemistry: Mass Spec	Winter
ETX 102B	5	Quantitative Analysis of Environmental Toxicants	Spring
ETX 111	3	Introduction to Mass Spectrometry	Winter
ETX 131	3	Environmental Toxicology of Air Pollutants	Fall
ETX 220*	3	Analysis of Toxicants	Fall
ETX 220L*	2	Analysis of Toxicants Laboratory	Fall
ETX 228	3	GC/Mass Spectrometry of Toxic Chemicals	Alternate Winter
ETX 240	3	Ecotoxicology	Alternate Spring
GEL 132	3	Introductory Inorganic Geochemistry	Alternate Fall
GEL 146	3	Radiogenic Isotope Geochem and Cosmochemistry	Alternate Fall
GEL 148	3	Stable Isotopes and Geochemical Tracers	Irregular Spring
PLS 205	5	Experimental Design & Analysis	Winter
SSC 111	4	Soil Microbiology	Winter
SSC 211	3	Advance Soil Microbiology	Alternate Fall
VEN 223*	4	Instrumental Analysis of Must and Wine	Irregular

*May be taken as an Elective in Other Chemistry if not taken as a Core Course.

Appendix D: Elective Courses in Environmental Science/Policy for MS Plan II

Course	Units	Title	Quarter Offered
ATM 115	3	Hydroclimatology	Alternate Spring
ATM 116	3	Modern Climate Change	Fall
ATM 124	3	Meteorological Instruments and Observations	Alternate Fall
ECI 149	4	Air Pollution	Fall
ECI 246N	4	Climate Change: Causes & Consequences	Spring
ESM 100	4	Principles of Hydrologic Science	Fall
ESM 108	3	Environmental Monitoring	Spring
ESM 120	4	Global Environmental Interactions	Winter
ESM 121	3	Water Science and Management	Fall
ESM 131	3	Air as a Resource	Winter
ESP 110	4	Principles of Environmental Science	Winter
ESP 116N	3	Oceanography	Alternate Winter
ESP 150A	4	Physical and Chemical Oceanography	Fall
ESP 151	4	Limnology	N/A
ESP 155	4	Wetland Ecology	Fall
ESP 160	4	The Policy Process	Spring
ESP 161	4	Environmental Law	Spring
ESP 162	4	Environmental Policy	Winter
ESP 163	4	Energy and Environmental Aspects of Transportation	Alternate Fall
ESP 165N	3	Climate Policy	Spring
ESP 166N	3	Ocean and Coastal Policy	Alternate Winter
ESP 167	4	Energy Policy	Alternate Spring
ESP 169	3	Water Policy and Politics	Alternate Spring
ESP 179	4	Environmental Impact Assessment	Winter
ETX 101	4	Principles of Environmental Toxicology	Fall
ETX 103A	4	Biological Effects of Toxicants	Winter
ETX 120	4	Perspectives in Aquatic Toxicology	Alternate Winter
ETX 131	3	Environmental Toxicology of Air Pollutants	Fall
ETX 135	3	Health Risk Assessment of Toxicants	Fall
ETX 138	3	Legal Aspects of Environmental Toxicology	Winter
GEL 108	3	Earth History: Paleoclimates	Spring
GEL 130	3	Non-Renewable Natural Resources	Alternate Fall
GEL 139	4	Rivers: Form, Function, and Management	Alternate Fall
HYD 141	4	Physical Hydrology	Fall
HYD 142	4	Systems Hydrology	Winter
HYD 143	3	Hydrological Processes in Ecosystems	Alternate Winter
HYD 144	4	Groundwater Hydrology	Alternate Fall
HYD 146	5	Hydrogeology and Contaminant Transport	Winter
HYD 150	3	Water Law	Winter
HYD 151	4	Field Methods in Hydrology	Alternate Winter
SSC 100	5	Principles of Soil Science	Fall
SSC 109	4	Sustainable Nutrient Management	Spring
SSC 111	4	Soil Microbiology	Winter
SSC 118	4	Soils in Land Use and the Environment	Spring
SSC 120	5	Soil Genesis, Morphology, and Classification	Spring

Appendix E: Example Course Plans for MS Plan II

1. Course plan with an atmospheric chemistry focus

Fall	*Winter*	*Spring*	*Summer*
ATM 116 (ES: 3)	ATM 160 (EC: 4)	ATM 260 (EC: 3)	AGC 299 (Research: 3)
CHE 233 (OC: 3)	ETX 102A (CC: 4)	STA 100 (ST: 4)	
ETX 220/220L (CC: 5)	ETX 111 (OC: 3)	SSC 219 (EC: 4)	
AGC 290-001 (Sem: 1)	AGC 290-001 (Sem: 1)	AGC 290-002 (Sem: 1)	
	GradPathways Speaking (PD)	GradPathways Writing (PD)	

			Unit Counts			
Fall		Course Type*	UG (≥100)	Grad Courses	290	292/299
ATM 116	Modern Climate Change	ES	3			
CHE 233	Physical-Organic Chemistry	OC		3		
ETX 220/220L	Analysis of Toxicants	CC		5		
AGC 290-001	Seminar	Sem			1	
Winter						
ATM 160	Introduction to Atmospheric Chemistry	EC	4			
ETX 102A	Environmental Fate of Toxicants	CC	4			
ETX 111	Introduction to Mass Spectrometry	OC	3			
AGC 290-001	Seminar	Sem			1	
GradPathways	Improving Presentations	PD				
Spring						
ATM 260	Atmospheric Chemistry	EC		3		
STA 100	Applied Statistics for Biological Sciences	ST	4			
SSC 219	Ecosystem Biogeochemistry	EC		4		
AGC 290-002	Seminar	Sem			1	
GradPathways	Graduate Writers Retreat	PD				
Summer						
AGC 299	Research					3
			a	b	c	d
		Totals	18	15	3	3

Comparison to Requirements	Taken	Req'd
Core Courses (ETX 102A *and* (CHE 219/291L or ETX 220/220L or VEN 223))	Yes	-
Statistics	Yes	-
Environmental Chemistry Units (total/grad)	11/7	≥ 9/6
Other Chemistry Units	6	≥ 3
Seminars (c)	3	≥ 2
Summer Research (299) or Internship (292) Units	3	≥ 3
Professional Development Workshops (at least two)	Yes	-
Graduate Units (b + up to 3 units of d)	18	18
Total Units (a + b + up to 5 units of c + up to 6 units of d)	39	39

*Key to course types: CC = Core Course, EC = Environmental Chemistry course, ES = Environmental Science/Policy course, OC = Other Chemistry course, PD = Professional Development, ST = Statistics course

Appendix E: Example Course Plans for MS Plan II, Continued

2. Course plan that samples a range of areas

Fall	*Winter*	*Spring*	*Summer*
STA 108 (ST: 4)	CHE 100 (EC: 4)	ECI 245B (EC: 4)	AGC 292 (Internship: 3)
ECI 247 (EC: 4)	CHE 219/219L (CC: 5)	ESM 108 (ES: 3)	
ETX 131 (OC: 3)	ETX 102A (CC: 4)	ECI 247L (EC: 4)	
AGC 290-001 (1)	AGC 290-001 (1)	AGC 290-002 (1)	
	GradPathways Speaking (PD)	AGC 299 (1)	
		GradPathways Writing (PD)	

			Unit Counts			
Fall		Course Type*	UG (≥100)	Grad Courses	290	292 or 299
STA 108	Appl Stat Methods: Regression Analysis	ST	4			
ETX 131	Environmental Tox of Air Pollutants	OC	3			
ECI 247	Aerosols	EC		4		
AGC 290-001	Seminar	Sem			1	
Winter						
CHE 100	Environmental Water Chemistry	EC	4			
CHE 219/219L	Spectroscopy of Organic Compounds	CC		5		
ETX 102A	Environmental Fate of Toxicants	CC	4			
AGC 290-001	Seminar	Sem			1	
GradPathways	Improving Presentations	PD				
Spring						
ECI 245B	Applied Env Chemistry: Organic	EC		4		
ECI 247L	Aerosols Laboratory	EC		4		
ESM 108	Environmental Monitoring	ES	3			
AGC 299	Research	Res				1
GradPathways	Graduate Writers Retreat	PD				
Summer						
AGC 292	Internship					3
			a	b	c	d
	Unit Totals		18	17	2	4

Comparison to Requirements		
	Taken	Req'd
Core Courses (ETX 102A *and* (CHE 219/291L or ETX 220/220L or VEN 223))	Yes	-
Statistics	Yes	-
Environmental Chemistry Units (total/grad)	16/12	≥ 9/6
Other Chemistry Units	3	≥ 3
Seminars (c)	2	≥ 2
Summer Research (299) or Internship (292) Units (d)	4	≥ 3
Professional Development Workshops (at least two)	Yes	-
Graduate Units (b + up to 3 units of d)	20	18
Total Units (a + b + up to 5 units of c + up to 6 units of d)	41	39

*Key to course types: CC = Core Course, EC = Environmental Chemistry course, ES = Environmental Science/Policy course, OC = Other Chemistry course, PD = Professional Development, ST = Statistics course

Appendix E: Example Course Plans for MS Plan II, Continued

3. Course plan with a soil and water chemistry focus

Fall	*Winter*	*Spring*	*Summer*
CHE 240 (OC: 3)	ETX 102A (CC: 4)	ETX 240 (OC: 3)	AGC 299 (Research: 3)
ETX 220/220L (CC: 5)	STA 106 (ST: 4)	HYD 134 (EC: 6)	
HYD 141 (ES: 4)	SSC 202 (EC: 4)	AGC 290-002 (1)	
AGC 290-001 (1)	AGC 290-001 (1)	GradPathways Writing (PD)	
	GradPathways Speaking (PD)		

			Unit Counts			
Fall		Course Type*	UG (≥100)	Grad Courses	290	292 or 299
CHE 240	Advanced Analytical Chemistry	OC		3		
ETX 220/220L	Analysis of Toxicants	CC		5		
HYD 141	Physical Hydrology	ES	4			
AGC 290-001	Seminar	Sem			1	
Winter						
ETX 102A	Environmental Fate of Toxicants	CC	4			
STA 106	Appl Stat Methods: Analysis of Variance	ST	4			
SSC 202	Topics in Advanced Soil Chemistry	EC		4		
AGC 290-001	Seminar	Sem			1	
GradPathways	Improving Presentations	PD				
Spring						
ECI 241	Env Reactive Chem Transport Modeling	EC		4		
HYD 134	Aqueous Geochemistry	EC	6			
GradPathways	Graduate Writers Retreat	PD				
Summer						
AGC 299	Research					3
			a	b	c	d
	Unit Totals		18	16	2	3

Comparison to Requirements		
	Taken	Req'd
Core Courses (ETX 102A *and* (CHE 219/291L or ETX 220/220L or VEN 223))	Yes	-
Statistics	Yes	-
Environmental Chemistry Units (total/grad)	14/8	≥ 9/6
Other Chemistry Units	3	≥ 3
Seminars (c)	2	≥ 2
Summer Research (299) or Internship (292)	3	≥ 3
Professional Development Workshops (at least two)	Yes	-
Graduate Units (b + up to 3 units of d)	19	18
Total Units (a + b + up to 5 units of c + up to 6 units of d)	39	39

*Key to course types: CC = Core Course, EC = Environmental Chemistry course, ES = Environmental Science/Policy course, OC = Other Chemistry course, PD = Professional Development, ST = Statistics course