

## **Degree Requirements**

### **Agricultural and Environmental Chemistry Graduate Group (AGC)**

Reviewed by Graduate Council: November 8, 2007

Approved by Graduate Council: December 12, 2007

#### Master's Degree Requirements:

##### 1. Admissions requirements:

###### a) Prerequisite

Applicants for admission must meet the University of California minimum GPA requirement for admission. In addition, applicants are expected to have the equivalent of the following courses:

- i) Organic Chemistry: Chemistry (CHE) 128 A, B, C
- ii) Physical Chemistry: Chemistry (CHE) 107 A, B or Chemistry 110 A, B, C
- iii) Inorganic Chemistry or Biochemistry: Chemistry (CHE) 124 A or Biology (BIS) 102, 103

Course work deficiencies should be made up by the end of the first academic year following initial enrollment by earning a letter grade of 'B' or better. Students with substantial course work to make up will be encouraged to pursue the M.S. degree.

###### b) Placement examinations

All students are required to take placement examinations in physical chemistry and either inorganic or organic chemistry upon entering the program. Examinations are given before the Fall quarter begins. The Program Manager provides incoming students with the exact dates, within the first two weeks of September, for the placement examinations.

The purpose of the placement examinations is to test a student's mastery of chemistry content taught in undergraduate courses. The examinations cover materials in standard undergraduate textbooks. A list of suggested texts to review in preparation for the exam is available upon request at the time of admission into the program.

Performance on the American Chemical Society Placement Examinations are based on national norms. Students must pass the placement examinations at the upper 50 percentile. Students who do not pass a placement exam are required to retake the exam or to complete the appropriate course work listed above.

The Placement Examination in general chemistry is not required. However, in order to qualify for a TA position in the Chemistry Department, students must pass the General Chemistry Exam that is available at the beginning of the Fall and Winter Quarters.

## 2. M.S. Degree Plan I:

Upon completion of the research project, a written thesis (Plan I) is required and no comprehensive exam is required.

## 3. Course Requirements:

## a. Core courses: (4-5 units)

All students are required to complete these courses without substitution. There are two required core courses. One course in chemical separations and analysis (either ETX 220, Analysis of Toxicants and ETX 220L Analysis of Toxicants Lab or VEN 223 Analysis of Must and Wine) and one course in chemical reaction mechanisms (either CHE 233, Physical-Organic Chemistry or CHE 226, Principles of Transition Metal Chemistry).

## b. Elective courses selected from the following areas :

## i) Statistics and Experimental Design (4 units)

One upper division or graduate level lecture course in Statistics or Experimental Design selected from the list below. If the student has taken an appropriate level of statistics prior to admission, another course may be substituted with approval by the graduate advisor. Students with previous undergraduate level statistics are encouraged to take a statistics or experimental design course appropriate to their research needs. Students without previous undergraduate level statistics are required to take STA100 or STA102.

## Admission Without Previous Undergraduate Level Statistics

STA100	Applied Statistics for Biological Sciences
STA102	Introduction to Probability Modeling and Statistical Inference

## Admission With Previous Undergraduate Level Statistics

STA106	Applied Statistical Methods: Analysis of Variance
STA108	Applied Statistical Methods: Regression Analysis
STA137	Applied Time Series Analysis
STA205	Statistical Methods for Research
STA223	Biostatistics: Generalized Linear Models
ECS124	Theory and Practice of Bioinformatics
PLS205	Experimental Design and Analysis

## ii) Specialization and Emphasis

A total of at least *12 units* of graduate coursework (not including seminars or units of 299) and at least 30 units total of all upper division and all graduate level course work (including seminars and units of 299) are required.

Three graduate lecture courses with a strong chemistry emphasis chosen from the list of available AGC electives. One upper-division course may be taken with approval by the graduate advisor. These course selections will allow students to specialize in the following areas: Environmental Chemistry; Analytical Chemistry, Food, Fiber and Polymer Chemistry; or Biological and Toxicological Chemistry. The list of elective courses will be reviewed, updated, and approved by the AGC Educational Policy Committee on an annual basis. Students are encouraged to recommend or organize specialization courses.

## 4. Special Requirements:

### Seminars

First-year students are required (and other students are encouraged) to attend the Faculty Research Seminar in the Fall Quarter, the Mechanics of Presenting a Seminar course in Winter Quarter, and the Journal Club in Spring Quarter. All students are required to attend, participate in, and satisfactorily complete Seminar (AGC 290) each quarter 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, but will be expected to attend another seminar series.

## 5. Committees:

### a) Admission Committee:

Once the completed application and all supporting materials and application fee have been received, the application will be submitted to the Admissions Committee. The Admissions Committee consists of at least 3 AGC Graduate Group members. Based on a review of the entire application, a recommendation is made to accept or decline an applicant's request for admission. That recommendation is forwarded to the Dean of Graduate Studies for final approval of admission. Notification of admissions decisions will be sent by Graduate Studies. Admission is open throughout the year.

### b) Course Guidance Committee:

After a student's admission to the program, the Graduate Advisor will appoint a Coursework Guidance Committee to meet with and establish a course of study for each individual. This committee consists of the student's major professor (chosen by student at the end of their rotation), the graduate advisor, and one other member who will design a curriculum plan based upon the student's needs and interests.

c) Thesis Committee:

The M.S. student in conjunction with their major professor and graduate advisor shall recommend a Thesis Committee consisting of the major professor (as chair, chosen by student) and at least two additional members to Graduate Studies. The recommended members not authorized by the Graduate Group Bylaws to serve on graduate thesis committees must be approved by the Dean of Graduate Studies. 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 (DDB 80. Graduate Council, B.1.). Refer to the Graduate Studies website for additional details regarding the filing of a thesis.

6. Advising Structure and Mentoring:

Major Professor is the faculty member who supervises the research and dissertation. Graduate Advisor is a resource for information on academic requirements, policies and procedures registration information until the Course Guidance Committee is formed. See Course Guidance committee for details from section 5b.

7. Thesis Requirements:

a. Evaluation

The M.S. 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. This committee will evaluate whether the thesis has been satisfactorily completed. Refer to the Graduate Studies website for additional details regarding the filing a thesis at <http://gradstudies.ucdavis.edu>

b. Exit Seminar

M.S. students are required to present a 50-minute exit seminar. If the student has not yet finished their degree by their 3<sup>rd</sup> year, they are required to present at the AGC Winter Colloquium.

8. Comprehensive Examination requirements:

There are no comprehensive examination requirements

## Ph.D. Degree Requirements

### 1. Admissions requirements:

#### a) Prerequisite

Applicants for admission must meet the University of California minimum GPA requirement for admission. In addition, applicants are expected to have the equivalent of the following courses:

- i) Organic Chemistry: Chemistry (CHE) 128 A, B, C
- ii) Physical Chemistry: Chemistry (CHE) 107 A, B or Chemistry 110 A, B, C
- iii) Inorganic Chemistry or Biochemistry: Chemistry (CHE) 124 A or Biology (BIS) 102, 103

Course work deficiencies should be made up by the end of the first academic year following initial enrollment by earning a letter grade of 'B' or better. Students with substantial course work to make up will be encouraged to pursue the M.S. degree. Students who have completed the M.S. degree must apply to the Ph.D. program for admittance.

#### b) Placement examinations

All students are required to take placement examinations in physical chemistry and either inorganic or organic chemistry upon entering the program or by completing the coursework above. The examinations are usually given before the Fall quarter begins. The Program Manager provides incoming students with the exact dates, within the first two weeks of September, for the placement examinations.

The purpose of the placement examinations is to test a student's mastery of chemistry content taught in undergraduate courses. The examinations cover materials in standard undergraduate textbooks. A list of suggested texts is available upon request.

Performance on placement examinations is based on national norms for the examination. Students must pass the placement examinations at the upper 50th percentile. Students who do not pass a placement exam are required to retake the exam or to complete the appropriate course work listed above.

The Placement Examination in general chemistry is not required. However, in order to qualify for a TA position in the Chemistry Department, students must pass the General Chemistry Exam that is available at the beginning of Fall and Winter Quarters.

2. Dissertation Plan: Dissertation Plan C is required and there is no dissertation defense. The timeline is typically two years upon completion of the qualifying exam.

### 3. Course Requirements

#### a. Core courses:

There are two required core courses. One course in chemical separations and analysis (either ETX 220, Analysis of Toxicants and ETX 220L Analysis of Toxicants Lab or VEN 223 Analysis of Must and Wine) and one course in chemical reaction mechanisms (either CHE 233, Physical-Organic Chemistry or CHE 226, Principles of Transition Metal Chemistry).

#### b. Elective courses:

##### i) Statistics and Experimental Design

One upper division or graduate level lecture course in Statistics or Experimental Design selected from the list below. If the student has taken an appropriate level of statistics prior to admission, another course may be substituted with approval by the graduate advisor. Students with previous undergraduate level statistics are encouraged to take a statistics or experimental design course appropriate to their research needs. Students without previous undergraduate level statistics are required to take STA100 or STA102.

#### Admission Without Previous Undergraduate Level Statistics

STA100	Applied Statistics for Biological Sciences
STA102	Introduction to Probability Modeling and Statistical Inference

#### Admission With Previous Undergraduate Level Statistics

STA106	Applied Statistical Methods: Analysis of Variance
STA108	Applied Statistical Methods: Regression Analysis
STA137	Applied Time Series Analysis
STA205	Statistical Methods for Research
STA223	Biostatistics: Generalized Linear Models
ECS124	Theory and Practice of Bioinformatics
PLS205	Experimental Design and Analysis

##### ii) Specialization and Emphasis

At least 19 units of all approved courses (of which 7 units can be upper-division courses) in addition to the seminar requirement and any research units (299).

Three graduate lecture courses with a strong chemistry emphasis chosen from the list of available AGC electives. One upper-division course may be taken with approval by the graduate advisor. These course selections will allow students to specialize in the following areas: Environmental and Analytical Chemistry; Food and Wine Chemistry, Fiber and Polymer Chemistry; or Biological and Toxicological Chemistry. The list of elective courses will be reviewed, updated, and approved by the Educational Policy

Committee on an annual basis. Students are encouraged to recommend or organize specialization courses.

c) Additional individual requirements

The Coursework Guidance Committee may make additional individual requirements. Students should consider taking further lecture courses as electives after they have passed their qualifying examination. Graduate Council's rules state that required courses are not to be taken with the Satisfactory/Unsatisfactory (S/U) option (elective courses may be taken S/U) and that a minimum course load is 12 units (including 299) each academic quarter.

4. Special Requirements:

a) Seminars

First-year students are required (and other students are encouraged) to attend the Faculty Research Seminar in the Fall Quarter, the Mechanics of Presenting a Seminar course in Winter Quarter, and the Journal Club in Spring Quarter. All students are required to attend, participate in, and satisfactorily complete Seminar (AGC 290) each quarter 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, but will be expected to attend another seminar series.

b) Teaching Experience:

Experience as a Teaching Assistant of 3-unit course or equivalent approved by the Coursework Guidance Committee. *In order to TA for the Chemistry Department, students must pass the General Chemistry Exam, available at the beginning of the Fall and Winter Quarters. All TAs must complete mandatory TA training as required by campus guidelines.*

5. Committees:

a) Admission Committee:

Once the completed application and all supporting materials and application fee have been received, the application will be submitted to the Admissions Committee. Based on a review of the entire application, a recommendation is made to accept or decline an applicant's request for admission. That recommendation is forwarded to the Dean of Graduate Studies for final approval of admission. Notification of admissions decisions will be sent by Graduate Studies.

b) Course Guidance Committee:

After a student's admission to the program, the Graduate Advisor will appoint a Coursework Guidance Committee to meet with and establish a course of study for each

at the end of their rotation), the graduate advisor, and one other member who will design a curriculum plan based upon the student's needs and interests.

c) Qualifying Examination Committee:

Each Ph.D. student in conjunction with the Coursework Guidance Committee will recommend a Qualifying Exam Committee consisting of five members. Three members from the graduate group and at least one member from outside the group. It is desirable to include one member of the Coursework Guidance Committee on the Qualifying Exam Committee.

The chair of the Qualifying Exam Committee in conjunction with the Executive Committee will then make any changes that are deemed necessary and make a recommendation for a Qualifying Exam Committee to Graduate Studies. The Qualifying Exam Committee is responsible for seeing that overall standards of quality and equity appropriate for the award of Ph.D. candidacy are met.

d) Dissertation Committee Requirements/Expectations

Qualifying Exam - All students will complete the course requirements before taking their qualifying examination. The qualifying examination should consist of written and oral examinations. This written research proposal should be provided to members of the qualifying examination committee at least 10 days before the qualifying exam.

Proposal: The written portion of the exam is the research proposal including, but not restricted to, an independently prepared proposal of 5-10 pages describing the student's dissertation-specific research aims, hypotheses, progress to date, and experimental approach. This research proposal should be provided to members of the qualifying examination committee at least 10 days before the qualifying exam. Concepts within the research proposal can be discussed with *others* (such as the student's major professor and peers), but the writing of *the* proposal should be solely the student's work (i.e., no editorial assistance is allowed) as the proposal will serve as evidence of the student's proficiency in scientific writing. The qualifying exam committee will be responsible for assessing that the student's writing proficiency is satisfactory before advancement to candidacy. Furthermore, the research proposal will provide information that may be discussed during the oral exam.

Oral: The oral portion of the qualifying exam is intended to demonstrate the student's critical thinking ability, powers of imagination and synthesis, and broad knowledge of the field of study. 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 based upon relevant portions of the student's previous academic record, performance on specific parts of the examination, and the student's potential for scholarly research as indicated during the examination.

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. In exceptional circumstances, a short



advancement to Ph.D. Candidacy. The student must file the appropriate paperwork with the Office of Graduate Studies, and pay the candidacy fee in order to be officially promoted to Ph.D. Candidacy. Refer to the Graduate Students website for additional details regarding the Qualifying Exam at <http://gradstudies.ucdavis.edu>

#### 6. Advising Structure and Mentoring:

Major Professor is the faculty member who supervises the research and dissertation. Graduate Advisor is a resource for information on academic requirements, policies and procedures registration information.

See Course Guidance committee for details, section 5b.

#### 7. Advancement to Candidacy:

The Qualifying Exam Committee votes to recommend pass, fail or not-pass to the Dean of Graduate Studies. In case of not-pass, the student is advised of his/her deficits, solutions to make up the deficits, and a timeline for completion. Upon the completion of the second attempt at the Qualifying Exam, the Qualifying Exam Committee votes a pass or fail vote to the Dean of Graduate Studies. Passing the qualifying exam makes the student eligible for Ph.D. Candidacy, upon submission of the appropriate paperwork and the candidacy fee to the Office of Graduate Studies.

#### 8. Dissertation requirements – Plan B:

Ph.D. candidates will complete a written dissertation that represents an original and significant contribution to the scientific body of knowledge. The dissertation committee will evaluate when this dissertation requirement has been met. Refer to the Graduate Studies website for additional details regarding the filing of a dissertation.

##### Presentations

In order to demonstrate adequate progress, Ph.D. students are expected to give a 50-minute exit seminar as well as three annual Winter Colloquium presentations beginning in the 2<sup>nd</sup> year. Students taking their Qualifying Exam during Winter quarter may be excused from presenting in the Winter Colloquium that quarter, but will still be expected to present three times.

Each student is responsible for advertising all of their seminars by sending announcements to all members of the graduate group and, if feasible, putting announcements in the UCD events calendar and in the UC Davis *Dateline*.

## Elective Courses

Course ID	Course title	06 - 07	07 - 08	Instructor
		---- not offered		
ATM 160	Intro to atmospheric chemistry	Winter	Winter	Anastasio
ATM 231	Adv air pollution meteorology	----	Fall	Carroll
ATM 260	Atmospheric chemistry	Spring	----	Anastasio
BIM 246	Magnetic resonance	Fall	Fall	Buonocore
CHE 205	Sym spectroscopy & structure	Winter	Winter	Staff
CHE 216	Magnetic resonance spectroscopy	----	Spring	True, Augustine, Britt
CHE 217	X-ray structure determination	Spring	Spring	Staff
CHE 218	Micro-molecular structure	Fall	----	Staff
CHE 219	Organic spectroscopy	Spring	Spring	Patten, Garvey, Hague
CHE 228A	Bio-inorganic chemistry	----	----	Staff
CHE 236	Chem of natural products	Winter	Winter	Staff
CHE 237	Bio-organic chemistry	----	Fall	Nambiar
CHE 240	Advance analytical chemistry	Fall	Fall	Fawcett, Land
CHE 241	Special topics in analytical chemistry	Fall	----	Guo, Fawcett, Lebrilla, Liu,
ECH 254	Colloid & surface phenomena	Spring	Spring	Stroeve, Longo
ECH 265	Micro emulsions & bilayers	Winter	Winter	Dungan
ECI 240	Water quality	Winter	Winter	Schladow
ECI 242	Air quality	----	Spring	Kleeman
ECI 243A	Water and waste treatment	Fall	Fall	Schroeder
ECI 245A	Applied environmental chemistry -inorganic	----	Spring	Young

ECI 245B	Applied environ chemistry -organic	Spring	----	Young
ECI 247	Aerosols	Fall	----	Kleeman
ECI 247L	Aerosols laboratory	----	Spring	Kleeman
ECS 124	Theory practice bioinformatics	Spring	Spring	Gusfield, Fikou
EMS 251	Solid state NMR	Spring	Spring	Risbud
ETX 214	Mechanisms of toxic action	----	Spring	Dennison, Hammock
ETX 220	Analysis of toxicants	Fall	Fall	Wood
ETX 220L	Analysis of toxicants Lab	Fall	Fall	Wood
ETX 228	GC/MS of toxic chemicals	----	Winter	Holstege
ETX 240	Ecotoxicology	Spring	Spring	Johnson, Miles
ETX 270	Toxicology of pesticides	----	Winter	Matsimura
FST 201	Food chem and biochem	Fall	Fall	Shoemaker, Frankel
FST 202	Chem & physical changes	All	Spring	Dungan
FST 203	Food processing	Winter	Winter	McCarthy , McCarthy
FST 207	Advanced sensory instrumental	Spring	Spring	Staff
FST 210	Proteins: functions, activities	----	----	Staff
FST 211	Lipids	Winter	Winter	German
GEL 227	Stable isotope biogeochemistry	----	----	Staff
HYD 143	Hydrologic processes in ecosystems	----	Fall	Pasternack
HYD 210	Modeling of vadose zone	----	Spring	Hoopmans
MCB 200B	Current techniques biochem	Winter	Winter	Kaplan
MCB200C	Current techniques biophysics	Winter	Winter	Jue
MCB 221A	Physical biochemistry	Fall	Fall	Baldwin, Schmid, Wilson, Stahlberg
MCB 221B	Mechanistic enzymology	Fall	Fall	Toney, Baldwin
MCB221D	Cellular biochemistrv	Winter	Winter	McNally Nunnari

MIC 263	Protein-nucleic acid interaction	----	----	Staff
NUT 201	Proteins: functions, activities	Spring	Spring	Rucker, Steinberg
NUT 254	Appl of systems analysis to nut	Winter	----	Fadel
PLS 205	Experimental design & analysis	Winter	Winter	Dubcovsky
PLS 211	Principles of HPLC	Spring	Spring	Goyal
PTX 201	Principles of pharm & tox I	Fall	Fall	Buckpitt
PTX 202	Principles of pharm & tox II	Winter	Winter	Pessah
RNU 401	Biomed radiochemistry	Spring	Spring	Bushbery, Vera
SSC 211	Advanced soil microbiology	----	Spring	Scow
SSC 219	Biogeochemistry	Spring	Spring	Dahlgren
SSC 222	Organic chemistry of soils	Winter	----	Horwath
STA 205	Statistical methods for research	----	Spring	Staff
VEN 210	Grape development & comp	----	Spring	Adams, Polit
VEN 219	Natural products in wine	Fall	Fall	Waterhouse
VEN 223	Instrument anal musts & wines	Spring	Spring	Ebeler
VMB 247	Natural toxicants	Spring	----	Staff
VMB 253	Metabolism of toxicants	----	----	Buckpitt

## Area of Specialization and Courses

Environmental Chemistry		Analytical Chemistry		Food, Fiber and Polymer Chemistry		Biological and Toxicological Chemistry	
ATM 160	Intro to atmospheric chemistry	BIM 246	Magnetic resonance	CHE 219	Organic spectroscopy	CHE 218	Micro-molecular structure
ATM 231	Adv air pollution meteorology	CHE 205	Sym spectroscopy & structure	CHE 236	Chem of natural products	CHE 219	Organic spectroscopy
ATM 260	Atmospheric chemistry	CHE 216	Magnetic resonance spectroscopy	CHE 241	Special topics in analytical chemistry	CHE 228A	Bio-inorganic chemistry
CHE 219	Organic spectroscopy	CHE 217	X-ray structure determination	ECH 254	Colloid & surface phenomena	CHE 236	Chem of natural products
CHE 240	Advance analytical chemistry	CHE 219	Organic spectroscopy	ECH 265	Micro emulsions & bilayers	CHE 237	Bio-organic chemistry
ECI 240	Water quality	CHE 240	Advance analytical chemistry	ECS 124	Theory practice bioinformatics	ECS 124	Theory practice bioinformatics
ECI 242	Air quality	CHE 241	Special topics in analytical chemistry	ETX 220	Analysis of toxicants	ETX 214	Mechanisms of toxic action
ECI 243A	Water and waste treatment	ECS 124	Theory practice bioinformatics	ETX 220L	Analysis of toxicants Lab	ETX 220	Analysis of toxicants
ECI 245A	Applied environmental chemistry -inorganic	EMS 251	Solid state NMR	ETX 228	GC/MS of toxic chemicals	ETX 220L	Analysis of toxicants Lab
ECI 245B	Applied environ chemistry -organic	ETX 220	Analysis of toxicants	FST 201	Food chem and biochem	ETX 228	GC/MS of toxic chemicals
ECI 247	Aerosols	ETX 220L	Analysis of toxicants Lab	FST 202	Chem & physical changes	ETX 270	Toxicology of pesticides
ECI 247L	Aerosols laboratory	ETX 228	GC/MS of toxic chemicals	FST 203	Food processing	MCB 200B	Current techniques biochem
ECS 124	Theory practice bioinformatics	FST 207	Advanced sensory instrumental	FST 207	Advanced sensory instrumental	MCB200C	Current techniques biophysics
ETX 220	Analysis of toxicants	PLS 205	Experimental design & analysis	FST 210	Proteins: functions, activities	PLS 205	Experimental design & analysis
ETX 220L	Analysis of toxicants Lab	PLS 211	Principles of HPLC	FST 211	Lipids	PTX 201	Principles of pharm & tox I
ETX 228	GC/MS of toxic chemicals	RNU 401	Biomed radiochemistry	MCB 221A	Physical biochemistry	PTX 202	Principles of pharm & tox II
			Statistical				Statistical

