

**CHEMISTRY AND BIOCHEMISTRY  
Ph.D. AND MS DEGREE REQUIREMENTS**

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# Chemistry and Biochemistry *Policies and Procedures*

## 1. Introduction

**1.1 Aims and Scope:** Research in the Chemistry and Biochemistry Graduate Group spans the subdisciplines of chemistry (organic, physical, inorganic, analytical, computational, and materials) and biochemistry. Current emphasis areas include Biochemistry/Molecular Biophysics, Computational, Materials, Organic/Organometallic/Inorganic, and Physical. The core of the Chemistry and Biochemistry graduate program is the completion of a piece of original scientific research leading to a Master's thesis or Ph.D. dissertation.

### **1.2 Admissions Requirements:**

Applicants must meet the minimum requirements for admission to graduate study at University of California, Merced, described in the Section II of the [Graduate Student Handbook](#). For admission into Chemistry and Biochemistry graduate program, submission of GRE scores on the general test or subject test are optional.

Admission decisions are made on a case-by-case basis. Meeting some or all of these criteria does not guarantee admission, but merely eligibility.

### **1.3 General Committees:**

**1.3.1 Executive Committee:** The Executive Committee determines and implements policy for the good of the Group and represents the interests of the Group to the University and other agencies.

**1.3.2 Admissions Committee:** The Admissions and Recruiting Committee is charged with recruiting students to the Group, developing recruiting materials, and otherwise publicizing the activities of the Group, and reviewing applications for admission.

**1.3.3 Educational Policy Committee:** The Educational Policy Committee (EPC) is responsible for establishing and guiding the educational programs of the Group. The EPC, in consultation with the group faculty, determines changes in coursework, exam, and teaching requirements for students in the Group. The EPC approves elective courses and handles student petitions for time extensions on exams, course waivers, and related issues.

## 2. Master's Degree Requirements

The recipient of a M.S. degree is understood to possess knowledge of a broad field of learning that extends well beyond that attained at the undergraduate level, but is not necessarily expected to have made a significant original contribution to knowledge in that field. The Master's degree may be attained through either the Thesis option (Plan I) or the Comprehensive

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Examination option (Plan II).

**2.1 Degree Plan I- Thesis:** In accordance with campus regulations, this plan requires a minimum of 24 semester units in approved courses, at least 20 of which must be earned in 200-series graduate-level courses exclusive of credit given for thesis research and preparation. Note that CHEM 295 research units may count towards the 20 unit minimum.

### **2.1.1 Program Learning Outcomes (PLOs):**

1. Possess the fundamental knowledge needed to understand and critically evaluate current research in their chosen subfield of chemistry;
2. Communicate fundamental concepts in their field as well as their own research effectively, in both written and oral form;
3. Conduct themselves ethically and responsibly in science-related professions; and
4. Be proficient in laboratory, theoretical, and/or computational techniques necessary to contribute to knowledge in their chosen subfield of chemistry.

### **2.1.2 Course Requirements - Core and Electives (total 24 units)**

Graduate level courses taken toward a graduate degree at another institution cannot be transferred for credit toward the M.S. degree in Chemistry and Biochemistry at UC Merced. However, a course requirement may be waived if a similar course was taken at another institution, if approved by both the faculty advisor and the Educational Policy Committee. If a particular course requirement is waived, the Educational Policy Committee may recommend that another graduate level course be taken as substitute. The General Petition form should be used for all requests for waivers of course work.

### **Course requirements for the M.S. degree in Chemistry and Biochemistry include:**

- Complete at least two semesters of full-time academic residence (12 units minimum per semester for students on University-administered fellowships, graduate student researcher appointments, and academic student employee appointments) at UC Merced;
- Complete a minimum of 24 semester units, at least 20 of which must be earned in 200 series graduate-level courses;
- Complete the required courses for one of the emphasis tracks as described below, with a letter grade of at least "B" in each course ("S" in seminar courses graded S/U);
- Earn a passing grade in a course addressing scientific ethics, approved by the Educational Policy Committee;

The minimum coursework requirements are determined by the student's research area. Elective classes can be any class listed as an option for any emphasis area (taken only one time for credit) or approved by the Educational Policy Committee. Students are

encouraged to determine elective classes by discussing with their faculty advisor and committee. Each emphasis area requires courses as follows:

### 2.1.2.1 Biochemistry/Molecular Biophysics emphasis

- ❖ Biochemistry (QSB 202) or Molecular Cell Biology (QSB 200)
- ❖ One of the following courses: Bioorganic Chemistry (CHEM 202), Principles of NMR Spectroscopy (CHEM 205), Molecular and Cell Biophysics (BIOE 205/CHEM 206), Statistical Thermodynamics (CHEM 214), Biological Imaging and Spectroscopy (BIOE 215/CHEM 216)
- ❖ One of the following courses: Introduction to Scientific Computing (CHEM 260), Introduction to Molecular Dynamics (CHEM 281), Bioinformatics (QSB 282), Computation and Modeling for Biological Sciences (PHYS 230)
- ❖ One graduate course elective (numbered 2xx and at least 3 units each)
- ❖ Two semesters of graduate seminar courses

### 2.1.2.2. Computational Chemistry emphasis

- ❖ Quantum Chemistry (CHEM 212)
- ❖ Statistical Thermodynamics (CHEM 214)
- ❖ Introduction to Molecular Dynamics (CHEM 281) or Molecular Electronic Structure (CHEM 225).
- ❖ One graduate course elective (numbered 2xx and at least 3 units) as approved by the Educational Policy Committee
- ❖ Two semesters of graduate seminar courses

### 2.1.2.3. Materials Chemistry emphasis

- ❖ Statistical Thermodynamics (CHEM 214)
- ❖ At least two of the following courses: Nanoscience (CHEM 240), Chemistry of Surfaces and Interfaces (CHEM 250), Supramolecular Materials Chemistry (CHEM 2XX), Structure and Properties of Materials (MBSE 210), Materials Properties (MBSE 211), Polymeric Materials (MBSE 224), Soft Matter Physics (PHYS 209), Condensed Matter Physics (PHYS 241)
- ❖ One graduate course elective (numbered 2xx and at least 3 units each)
- ❖ Two semesters of graduate seminar courses

### 2.1.2.4. Organic/Organometallic/Inorganic Chemistry emphasis

- ❖ At least three of the following four courses: Advanced Organic Synthesis (CHEM 200), Organic and Organometallic Reaction Mechanisms (CHEM 201), Reactions and Reactivity of Organometallic Chemistry (CHEM 210), Advanced Inorganic Chemistry (CHEM 220)
- ❖ One graduate course elective (numbered 2xx and at least 3 units each)
- ❖ Two semesters of graduate seminar courses

### 2.1.2.5. Physical Chemistry emphasis

- ❖ At least three of the following four courses: Quantum Chemistry (CHEM 212),

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Statistical Thermodynamics (CHEM 214), Chemical Kinetics (CHEM 215), and Molecular Spectroscopy (CHEM 231)

- ❖ One graduate course elective (numbered 2xx and at least 3 units) as approved by the Educational Policy Committee
- ❖ Two semesters of graduate seminar courses

Course electives must be regular graduate courses, not research or independent study. Courses offered by other graduate programs may be taken as electives but require approval of the Educational Policy Committee if not listed here. Course work beyond the minimum should be determined by the individual student's background and research topic in consultation with the faculty advisor and/or faculty advisory committee.

Students must maintain at least a 3.0 grade-point average to be considered in good academic standing or to be awarded an academic graduate degree. A student whose cumulative graduate grade-point average falls below 3.0 will be placed on academic probation. The student will then be allowed a maximum of two semesters to make up the deficiencies and be returned to good academic standing. Otherwise, the student will be recommended for academic disqualification by the Vice Provost and Dean of Graduate Education unless he or she successfully petitions the Academic Policy Committee for additional time.

**2.1.2.6. Summary:** The minimum course requirement is 12 units in four graduate level 3-unit courses for an emphasis, a 1-unit class in scientific ethics, two semesters of 1-unit graduate seminar courses, and remaining (5) units in graduate level courses for a sum of 20 units, and research and other (including upper division) courses, totaling 24 units. Full-time students on University-administered fellowships, graduate student researcher appointments, and academic student employee appointments must enroll for 12 units per semester including research, academic, and seminar units. Per UC regulations, ordinarily students shall not receive credits for more than 12 units of graduate level courses per semester.

### 2.1.3. Special Requirements:

**2.1.3.1 Open Technical Seminar:** The Chemistry and Biochemistry Graduate Group requires all graduate students pursuing the Master's degree to present an open technical seminar or research poster at least once each year. The topic of the presentation may be the student's own research or it may be any other topic that falls within the areas of study spanned by the group, broadly defined. The presentation may be given as part of a regular seminar series or as a special event. Seminars or posters presented away from UC Merced, *e.g.* at scientific conferences, count toward this requirement. The open presentation given as part of the Ph.D. defense may be counted as one of the required seminars. The Educational Policy Committee has the authority to determine whether a particular presentation meets this requirement.

**2.1.4 Advancement to Candidacy:** Before advancing to candidacy for the Master's degree, a student must have satisfied all plan requirements set by the graduate program and must have maintained a minimum GPA of 3.0, *or higher* in all course work undertaken. The student must file the appropriate paperwork (Application for Advancement to Candidacy for the Master's Degree and Conflict of Interest Form).

**2.1.5 Thesis Requirements:** The M.S. thesis requires a description of original research in the field. Should the Thesis Committee determine that the thesis is unacceptable, a recommendation to disqualify the student may be made to the Vice Provost and Dean of Graduate Education.

Detailed information and instructions on the submission and filing of the thesis is available in the UCM Thesis and Dissertational Manual. A schedule of dates for filing the thesis in final form are published on the Graduate Division website in the [Dates and Deadlines section](#).

**2.2 Degree Plan II- Non-thesis:** In accordance with campus regulations, this plan requires a minimum of 24 semester units in approved courses, at least 20 of which must be earned in 200-series graduate-level courses exclusive of credit given for thesis research and preparation. Note that CHEM 295 research units may count towards the 20 unit minimum. A comprehensive oral exam is required of each candidate on this degree plan. No thesis is required.

**2.2.1 Program Learning Outcomes (PLOs):**

1. Possess the fundamental knowledge needed to understand and critically evaluate current research in their chosen subfield of chemistry;
2. Communicate fundamental concepts in their field as well as their own research effectively, in both written and oral form; and
3. Conduct themselves ethically and responsibly in science-related professions.

**2.2.2 Course Requirements - Core and Electives (minimum total 24 units)**

Graduate level courses taken toward a graduate degree at another institution cannot be transferred for credit toward the M.S. degree in Chemistry and Biochemistry at UC Merced. However, a course requirement may be waived if a similar course was taken at another institution, if approved by both the faculty advisor and the Educational Policy Committee. If a particular course requirement is waived, the Educational Policy Committee may recommend that another graduate level course be taken as substitute. The General Petition form should be used for all requests for waivers of course work.



### Course requirements for the M.S. degree in Chemistry and Biochemistry include:

- Complete at least two semesters of full-time academic residence (12 units minimum per semester for students on University-administered fellowships, graduate student researcher appointments, and academic student employee appointments) at UC Merced;
- Complete a minimum of 24 semester units, at least 20 of which must be earned in 200 series graduate-level courses;
- Complete the required courses for one of the emphasis tracks as described below, with a letter grade of at least "B" in each course ("S" in seminar courses graded S/U);
- Earn a passing grade in a course addressing scientific ethics, approved by the Educational Policy Committee;

The minimum coursework requirements are determined by the student's research area. Elective classes can be any class listed as an option for any emphasis area (taken only one time for credit) or approved by the Educational Policy Committee. Students are encouraged to determine elective classes by discussing with their faculty advisor and committee. Each emphasis area requires courses as follows:

#### 2.2.2.1. Biochemistry/Molecular Biophysics emphasis

- ❖ Biochemistry (QSB 202) or Molecular Cell Biology (QSB 200)
- ❖ One of the following courses: Bioorganic Chemistry (CHEM 202), Principles of NMR Spectroscopy (CHEM 205), Molecular and Cell Biophysics (BIOE 205/CHEM 206), Statistical Thermodynamics (CHEM 214), Biological Imaging and Spectroscopy (BIOE 215/CHEM 216)
- ❖ One of the following courses: Introduction to Scientific Computing (CHEM 260), Introduction to Molecular Dynamics (CHEM 281), Bioinformatics (QSB 282), Computation and Modeling for Biological Sciences (PHYS 230)
- ❖ One graduate course elective (numbered 2xx and at least 3 units each)
- ❖ Two semesters of graduate seminar courses

#### 2.2.2.2. Computational Chemistry emphasis

- ❖ Quantum Chemistry (CHEM 212)
- ❖ Statistical Thermodynamics (CHEM 214)
- ❖ Introduction to Molecular Dynamics (CHEM 281) or Molecular Electronic Structure (CHEM 225).
- ❖ Graduate course elective (numbered 2xx and at least 3 units) as approved by the Educational Policy Committee
- ❖ Two semesters of graduate seminar courses

#### 2.2.2.3. Materials Chemistry emphasis

- ❖ Statistical Thermodynamics (CHEM 214)
- ❖ At least two of the following courses: Nanoscience (CHEM 240), Chemistry of Surfaces and Interfaces (CHEM 250), Supramolecular Materials Chemistry

(CHEM 2XX), Structure and Properties of Materials (MBSE 210), Materials Properties (MBSE 211), Polymeric Materials (MBSE 224), Soft Matter Physics (PHYS 209), Condensed Matter Physics (PHYS 241)

- ❖ One graduate course elective (numbered 2xx and at least 3 units each)
- ❖ Two semesters of graduate seminar courses

**2.2.2.4. Organic/Organometallic/Inorganic Chemistry emphasis**

- ❖ At least three of the following four courses: Advanced Organic Synthesis (CHEM 200), Organic and Organometallic Reaction Mechanisms (CHEM 201), Reactions and Reactivity of Organometallic Chemistry (CHEM 210), Advanced Inorganic Chemistry (CHEM 220)
- ❖ One graduate course elective (numbered 2xx and at least 3 units each)
- ❖ Two semesters of graduate seminar courses

**2.2.2.5. Physical Chemistry emphasis**

- ❖ At least three of the following four courses: Quantum Chemistry (CHEM 212), Statistical Thermodynamics (CHEM 214), Chemical Kinetics (CHEM 215), and Molecular Spectroscopy (CHEM 231)
- ❖ One graduate course elective (numbered 2xx and at least 3 units) as approved by the Educational Policy Committee
- ❖ Two semesters of graduate seminar courses

Course electives must be regular graduate courses, not research or independent study. Courses offered by other graduate programs may be taken as electives but require approval of the Educational Policy Committee if not listed here. Course work beyond the minimum should be determined by the individual student's background and research topic in consultation with the faculty advisor and/or faculty advisory committee.

Students must maintain at least a 3.0 grade-point average to be considered in good academic standing or to be awarded an academic graduate degree. A student whose cumulative graduate grade-point average falls below 3.0 will be placed on academic probation. The student will then be allowed a maximum of two semesters to make up the deficiencies and be returned to good academic standing. Otherwise, the student will be recommended for academic disqualification by the Vice Provost and Dean of Graduate Education unless he or she successfully petitions the Academic Policy Committee for additional time.

**2.2.2.6. Summary:** The minimum course requirement is 12 units in four graduate level 3-unit courses for an emphasis, a 1-unit class in scientific ethics, two semesters of 1-unit graduate seminar courses, and remaining (5) units in graduate courses and research for a sum of 20 units, plus 4 units in other (including upper division) courses, totaling 24 units. Full-time students on University-administered fellowships, graduate student researcher appointments, and academic student employee appointments must enroll for 12 units per semester including research,

academic and seminar units. Per UC regulations, ordinarily students shall not receive credits for more than 12 units of graduate level courses per semester.

### 2.2.3. Special Requirements:

**2.2.3.1. Open Technical Seminar:** The Chemistry and Biochemistry Graduate Group requires all graduate students pursuing the Master's degree to present an open technical seminar or research poster at least once each year. The topic of the presentation may be the student's own research or it may be any other topic that falls within the areas of study spanned by the group, broadly defined. The presentation may be given as part of a regular seminar series or as a special event. Seminars or posters presented away from UC Merced, *e.g.* at scientific conferences, count toward this requirement. The open presentation given as part of the Ph.D. defense may be counted as one of the required seminars. The Educational Policy Committee has the authority to determine whether a particular presentation meets this requirement.

**2.2.4 Advancement to Candidacy:** Before advancing to candidacy for the Master's degree, a student must have satisfied all plan requirements set by the graduate program and must have maintained a minimum GPA of 3.0, or higher in all course work undertaken. The student must file the appropriate paperwork (Application for Advancement to Candidacy for the Master's Degree).

### 2.2.5 Comprehensive Examination:

**2.2.5.1 Timing:** Students may take the comprehensive examination once they have completed two of the required 200 level, 3-unit courses. Students must be registered or in current filing fee status at the time when they take the examination.

**2.2.5.2 Examination:** The comprehensive oral examination is administered by the Faculty Advisory Committee. The exam tests the student's understanding of the main concepts in the field at the graduate level. The Faculty Advisory Committee determines if the student demonstrates adequate knowledge to earn a M.S. at the University of California.

**2.2.5.3 Outcome:** Examinations can result in either a pass, fail, or partial pass by unanimous consensus of the Comprehensive Examination Committee. Per campus regulations, exam committees must reach a decision unanimously. If need be, an exam committee can be reconstituted to ensure a unanimous decision. The results, as well as the procedures for repeating a failed examination, are described in Section VI. F of Graduate P&P Handbook. The committee must report the result to the Graduate Council via the Vice Provost and Dean of Graduate Education within 30 days, using the Final

Report for the Master's Degree Form found on the Graduate Division website.

### 2.3 Degree Plan- Professional Masters

*Policies and Procedures* for Professional Masters programs are in development at the campus level.

### 2.4. Advising Structure and Mentoring

**2.4.1 Advising Structure:** A graduate student is expected to have a faculty advisor at all times during their graduate studies. In the absence of a faculty advisor, the Graduate Group Chair becomes the student's temporary advisor.

The Graduate Group Chair acts as the initial faculty advisor for students entering the graduate program until a more permanent faculty advisor is determined. Students are encouraged to discuss research with faculty whose work interests them and to do a rotation to help both students and faculty determine if there is a good fit. The chair will help to facilitate the research rotations based on student-faculty mutual interest and the schedule of students and faculty. By the first day of the second month of the second semester in residence, students should submit their faculty advisor preferences in a ranked list to the graduate chair. The chair will work with the faculty to assign the faculty advisor.

If the student is not able to find a faculty advisor willing to supervise their research, the student should discuss their difficulties with the Graduate Chair. If at the conclusion of the second semester in residence a suitable faculty advisor is not determined, then the student will be recommended for academic disqualification from the program, unless the student successfully petitions the EPC for an extension. If all non-thesis Master's degree requirements have been met, the student may seek out an advisor for their comprehensive oral exam and leave the program with a Master's degree.

As a Graduate Group, we care about each student's well-being and progress in the graduate program. We encourage all students to find a community of mentors, both near-peer (other students) and faculty mentors, even faculty outside of a student's main faculty advisor.

Students needing additional resources, support, and advising beyond what faculty can provide can find more information on food support, housing security, financial and mental wellness, and other basic needs at UC Merced's Basic Needs website.

**2.4.2 Faculty Advisory Committee:** The faculty advisor, in consultation with the student and program faculty, recommends appointment of faculty members to advise on and supervise

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the student's research, serve on the examination committee, and review and pass upon the merits of the thesis/dissertation. Final approval of the membership of this Faculty Advisory Committee rests with the Vice Provost and Dean of Graduate Education.

Faculty Advisory Committees consist of at least four members, three of whom must be members of the Graduate Group and one who must be from outside the group (external member). One member is the student's faculty advisor (major professor). If the student would like to work with a faculty advisor outside of the Graduate Group, the student should consult first with and have approval from the Graduate Chair, and then form their Faculty Advisory Committee consisting of three members of the Graduate Group faculty and their advisor who will act as the external member. Before the student joins the group of a faculty member outside of the Graduate Group and begins research, all members of the Faculty Advisory Committee should meet with the student to formulate a research plan that is appropriate for a graduate student in the Chemistry and Biochemistry graduate program and all should agree that the faculty advisor has the necessary expertise to advise a student in conducting chemistry research. One member of the committee, who is not the faculty advisor but must be from the Graduate Group, is appointed as Chair. The external member may be a regular or adjunct faculty member from any UC campus or an individual from outside the University of California who has special expertise and qualifications. In this case, the faculty advisor should submit a brief statement indicating the appointee's affiliation and title and how the prospective appointee has special expertise or qualifications that are not represented on the campus. In addition to the justification letter from the faculty advisor, a curriculum vitae and a letter from the proposed appointee indicating a willingness to serve must be submitted to the Vice Provost and Dean of Graduate Education for review and approval. Detailed instructions are found in Graduate Policies and Procedures, at the [Graduate Division Website](#). If potential conflict of interest issues exist as defined by Graduate Division policy, an additional Oversight Member must also be appointed.

The majority of the committee (three members) should be appointed no later than the end of the second semester in residence, with the external member not required to be appointed until the thesis needs to be reviewed or until the comprehensive oral examination, unless the faculty advisor is acting as the external member and in this case must be part of the committee.

Reconstitution of the committee may be justified by a substantial change in the student's thesis topic or may be required by the departure of a committee member from the university. When membership changes must be made, the faculty advisor in consultation with the student should recommend a new committee member, giving the reason for the change. The new committee members and the reason for the change must be submitted to the Vice Provost and Dean of Graduate Education.

### **2.4.3 Evaluation of Student Progress**

In order to ensure satisfactory progress toward the degree, each student must meet with his or her faculty committee for an annual review of progress at a mutually agreeable time prior to the first day of each Fall semester. At least three members of the committee, including the faculty advisor, must be present in-person or virtually. The committee will review the student's progress toward the degree during the past year and provide feedback and recommendations. Should the committee conclude that the student is not making satisfactory progress toward the degree, the student may be placed on academic probation. The student will then be allowed a maximum of two semesters to make up the deficiencies and be returned to good academic standing. Otherwise, the student will be recommended for academic disqualification by the Vice Provost and Dean of Graduate Education unless he or she successfully petitions the Educational Policy Committee for additional time.

### 2.4.4 Grievance Procedures

Before each annual faculty committee meeting, students should fill out the mentoring survey to provide feedback about their mentoring experience with their faculty advisor. The survey results go to the Graduate Chair and the Faculty Advisory Committee Chair to help them guide the student and faculty advisor and improve communication. Our program aims to create a supportive and positive mentoring culture and to work through conflicts before they escalate to allow students to focus on training and research.

Students or faculty advisors experiencing conflicts and wanting to discuss or report grievances are encouraged to consult with the Graduate Chair or the Faculty Advisory Committee Chair. Students may also want to use the resources at the [Graduate Division](#) or [other campus resources](#) for resolving conflicts or filing a complaint.

## 2.5. Master's Degree Committees:

**2.5.1 Thesis Committee:** All members of the Faculty Advisory Committee must approve the Master's thesis.

**2.5.2 Comprehensive Examination Committee:** All members of the Faculty Advisory Committee must be in attendance at the comprehensive oral examination. If a committee member's absence from campus for an extended period of time makes scheduling of examinations unreasonably difficult, the student may request that the committee be reconstituted.

**2.6 Normative Time to Degree:** For students who are engaged in full-time study and making adequate progress, it is expected that they would advance to candidacy and complete the degree in two years.

**2.7 Typical Timeline and Sequence of Events:** The goals and needs of individual students vary considerably, and no single plan will accommodate all students. Therefore, the following program of study should be considered as a general guide only. In particular, the following example illustrates a 2-year program of study, which may not be appropriate for all students.

<b>Typical timeline for M.S. program</b>	
Year 1	Choose faculty advisor and begin research Complete most required courses Constitute and meet with Faculty Advisory Committee (usually during the summer)
Year 2	Complete remaining courses Make progress in research Pass oral M.S. exam or work on writing up M.S. thesis

**2.8 Sources of Funding:**

M.S. degrees are often self-funded, and Ph.D. students will receive priority over M.S. students for teaching assistant (TA) positions. Students may be supported as graduate student researchers (GSRs) depending on availability of TAs and the faculty advisor's funding for GSR positions. Students serving as GSRs during the academic year are appointed at 49.9% at the step for which the monthly stipend is most nearly equal to that for a first-year TA in the School of Natural Sciences. GSRs do not accrue paid vacation time. Exceptions to these policies may be made at the recommendation of the student's faculty advisor, the Graduate Chair, and the Vice Provost and Dean of Graduate Education, if necessary.

**3. Doctoral Degree Requirements**

The Doctor of Philosophy degree is not granted by the University of California merely for the fulfillment of technical requirements, such as residence or the completion of fundamental courses. The recipient of a Ph.D. degree is understood to possess thorough knowledge of a broad field of learning and to have given evidence of distinguished accomplishment in that field; the degree is a warrant of critical ability and powers of imaginative synthesis. The degree also signifies that

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the recipient has presented a doctoral dissertation containing an original contribution to knowledge in his or her chosen field of study.

### **3.1 Program Learning Outcomes (PLOs):**

1. Possess the fundamental knowledge needed to understand and critically evaluate current research in their chosen subfield of chemistry;
2. Communicate fundamental concepts in their field as well as their own research effectively, in both written and oral form;
3. Conduct themselves ethically and responsibly in science-related professions;
4. Be proficient in laboratory, theoretical, and/or computational techniques necessary to contribute to knowledge in their chosen subfield of chemistry; and
5. Identify new research opportunities, plan effective strategies for pursuing these opportunities, and conduct research that makes a new contribution to knowledge in their chosen subfield of chemistry.

### **3.2 Course Requirements - Core and Electives (minimum total 48 units)**

Graduate level courses taken toward a graduate degree at another institution cannot be transferred for credit toward the M.S. degree in Chemistry and Biochemistry at UC Merced. However, a course requirement may be waived if a similar course was taken at another institution, if approved by both the faculty advisor and the Educational Policy Committee. If a particular course requirement is waived, the Educational Policy Committee may recommend that another graduate level course be taken as substitute. The General Petition form should be used for all requests for waivers of course work.

#### **Course requirements for the Ph.D. degree in Chemistry and Biochemistry include:**

- Complete at least four semesters of full-time academic residence (12 units minimum per semester for students on University-administered fellowships, graduate student researcher appointments, and academic student employee appointments) at UC Merced;
- Complete a minimum of 48 semester units;
- Complete the required courses for one of the emphasis tracks as described below, with a letter grade of at least "B" in each course ("S" in seminar courses graded S/U); Note the possibility of a course waiver for previous graduate courses mentioned above.
- Earn a passing grade in a course addressing scientific ethics, approved by the Educational Policy Committee;

The minimum coursework requirements are determined by the student's emphasis and research area. Elective classes can be any class listed as an option for any emphasis area (taken only one time for credit) or approved by the Educational Policy Committee. Students are encouraged to determine elective classes by discussing with their faculty advisor and committee. Each emphasis area requires courses as follows:



**3.2.1. Biochemistry/Molecular Biophysics emphasis**

- ❖ Biochemistry (QSB 202) or Molecular Cell Biology (QSB 200)
- ❖ One of the following courses: Bioorganic Chemistry (CHEM 202), Principles of NMR Spectroscopy (CHEM 205), Molecular and Cell Biophysics (BIOE 205/CHEM 206), Statistical Thermodynamics (CHEM 214), Biological Imaging and Spectroscopy (BIOE 215/CHEM 216)
- ❖ One of the following courses: Introduction to Scientific Computing (CHEM 260), Introduction to Molecular Dynamics (CHEM 281), Bioinformatics (QSB 282)
- ❖ One graduate course elective (numbered 2xx and at least 3 units each)
- ❖ Four semesters of graduate seminar courses

**3.2.2. Computational Chemistry emphasis**

- ❖ Quantum Chemistry (CHEM 212)
- ❖ Statistical Thermodynamics (CHEM 214)
- ❖ Introduction to Molecular Dynamics (CHEM 281) or Molecular Electronic Structure (CHEM 225).
- ❖ One graduate course elective (numbered 2xx and at least 3 units) as approved by the Educational Policy Committee
- ❖ Four semesters of graduate seminar courses

**3.2.3. Materials Chemistry emphasis**

- ❖ Statistical Thermodynamics (CHEM 214)
- ❖ At least two of the following courses: Nanoscience (CHEM 240), Chemistry of Surfaces and Interfaces (CHEM 250), Supramolecular Materials Chemistry (CHEM 2XX), Structure and Properties of Materials (MBSE 210), Materials Properties (MBSE 211), Polymeric Materials (MBSE 224), Soft Matter Physics (PHYS 209), Condensed Matter Physics (PHYS 241)
- ❖ One graduate course elective (numbered 2xx and at least 3 units each)
- ❖ Four semesters of graduate seminar courses

**3.2.4. Organic/Organometallic/Inorganic Chemistry emphasis**

- ❖ At least three of the following four courses: Advanced Organic Synthesis (CHEM 200), Organic and Organometallic Reaction Mechanisms (CHEM 201), Reactions and Reactivity of Organometallic Chemistry (CHEM 210), Advanced Inorganic Chemistry (CHEM 220)
- ❖ One graduate course elective (numbered 2xx and at least 3 units each)
- ❖ Four semesters of graduate seminar courses

**3.2.5. Physical Chemistry emphasis**

- ❖ At least three of the following four courses: Quantum Chemistry (CHEM 212), Statistical Thermodynamics (CHEM 214), Chemical Kinetics (CHEM 215), and Molecular Spectroscopy (CHEM 231)
- ❖ One graduate course elective (numbered 2xx and at least 3 units) as approved by the Educational Policy Committee

- ❖ Four semesters of graduate seminar courses

Course electives must be regular graduate courses, not research or independent study. Courses offered by other graduate programs may be taken as electives but require approval of the Educational Policy Committee if not listed here. Course work beyond the minimum should be determined by the individual student's background and research topic in consultation with the faculty advisor and/or Faculty Advisory Committee.

Students must maintain at least a 3.0 grade-point average to be considered in good academic standing or to be awarded an academic graduate degree. A student whose cumulative graduate grade-point average falls below 3.0 will be placed on academic probation. The student will then be allowed a maximum of two semesters to make up the deficiencies and be returned to good academic standing. Otherwise, the student will be recommended for academic disqualification by the Vice Provost and Dean of Graduate Education unless he or she successfully petitions the Educational Policy Committee for additional time.

**3.2.6. Summary:** The course requirement is 12 units in four graduate level 3-unit courses, a 1-unit class in scientific ethics, and four semesters of 1-unit graduate seminar courses, with the remaining units research to total at minimum 48 units. Full-time students on University-administered fellowships, graduate student researcher appointments, and academic student employee appointments must enroll for 12 units per semester including research, academic and seminar units. Per UC regulations, ordinarily students shall not receive credits for more than 12 units of graduate level courses per semester.

### 3.3 Special Requirements:

**3.3.1 Teaching Requirement:** The Chemistry and Biochemistry Graduate Group requires all graduate students pursuing the Ph.D. to acquire teaching experience at the post-secondary level under faculty supervision, for at least one semester. This requirement is usually satisfied by appointment as a Teaching Assistant or Teaching Fellow in undergraduate courses. For more information, consult the Academic Appointment and Graduate Student Employment section in the Graduate Policies and Procedures Handbook.

**3.3.2 Proficiency Exams:** The Chemistry and Biochemistry Graduate Group requires all graduate students pursuing the Ph.D. to achieve a passing score on a series of journal-based exams that are administered three times throughout the year. Exams are based on journal articles spanning different subdisciplines of chemistry. Each exam will be graded as worth 0, 1, 2, or 3 points. A score of 3 points demonstrates a knowledge level sufficient to proceed in the Ph.D. program, a score of 2 points

demonstrates that the student has deficiencies that need to be addressed and that the current knowledge level is more appropriate for a Master's degree level, a score of 1 point demonstrates substantial deficiencies that need to be addressed, and a score of 0 points is earned if the majority of the questions are left blank or show very little understanding. To achieve a passing grade and satisfy the Ph.D. requirement, students are required to acquire 6 points total and to have one score of 3 points on a given exam.

The exam may be taken each time it is offered, and a passing score should be reached no later than the start of the fourth semester (a maximum of five attempts). If a student has not achieved a passing score after three attempts, the performance on the exam should be discussed at the first annual committee meeting and the committee may provide advice and guidance for future attempts.

Students who have not achieved a passing score by the start of the fourth semester (a maximum of five attempts) will be recommended for either transition to the M.S. track or academic disqualification from the graduate program, unless they successfully petition the Educational Policy Committee for an extension.

**3.3.3 Open Technical Seminar:** The Chemistry and Biochemistry Graduate Group requires all graduate students pursuing the Ph.D. to present an open technical seminar or research poster at least once each year. The topic of the presentation may be the student's own research or it may be any other topic that falls within the areas of study spanned by the group, broadly defined. The presentation may be given as part of a regular seminar series or as a special event. Seminars or posters presented away from UC Merced, *e.g.* at scientific conferences, count toward this requirement. The open presentation given as part of the Ph.D. defense may be counted as one of the required seminars. The Educational Policy Committee has the authority to determine whether a particular presentation meets this requirement.

**3.4 Dissertation Plan:** In accordance with University of California policy, a minimum of four semesters in academic residence is required prior to awarding the Ph.D. Typically, a longer period of study, four to six years, is required for completion of all degree requirements. All graduate students are considered resident graduates not candidates for a degree, unless admitted to candidacy after completion of all candidacy requirements and approval by the Graduate Division after formal application. A student advances to candidacy for the Ph.D. upon successfully demonstrating a high level of scholarship at the Ph.D. level, passing the qualifying exam, upon completing all preparatory work, and demonstrating readiness to proceed to the dissertation phase. Section 3.9 provides more detailed information on the dissertation phase.

### **3.5 Advising Structure and Mentoring:**

**3.5.1 Advising Structure:** A graduate student is expected to have a faculty advisor at all times during their graduate studies. In the absence of a faculty advisor, the Graduate Chair becomes the student's temporary advisor.

The Graduate Chair acts as the initial faculty advisor for students entering the graduate program until a more permanent faculty advisor is determined. Students are encouraged to discuss research with faculty whose work interests them and to do a rotation to help both students and faculty determine if there is a good fit. The chair will help to facilitate the research rotations based on mutual interest and the schedule of students and faculty. By the first day of the second month of the second semester in residence, students should submit their faculty advisor preferences in a ranked list to the Graduate Chair. The Graduate Chair will work with the faculty to assign the faculty advisor.

If the student is not able to find a faculty advisor willing to supervise their research, the student should discuss their difficulties with the Graduate Chair. If at the conclusion of the second semester in residence a suitable faculty advisor is not determined, then the student will be recommended for academic disqualification from the program, unless the student successfully petitions the EPC for an extension. If all non-thesis Master's degree requirements have been met, the student may seek out an advisor for their comprehensive oral exam and leave the program with a Master's degree.

The Chemistry and Biochemistry Graduate Group has adopted the [GC approved Mentoring Guidelines](#).

As a Graduate Group, we care about each student's well-being and progress in the graduate program. We encourage all students to find a community of mentors, both near-peer (other students) and faculty mentors, even faculty outside of a student's main faculty advisor.

Students needing additional resources, support, and advising beyond what faculty can provide can find more information on food support, housing security, financial and mental wellness, and other basic needs at UC Merced's Basic Needs website.

**3.5.2 Faculty Advisory Committee:** The faculty advisor, in consultation with the student and program faculty, recommends appointment of faculty members to advise on and supervise the student's research, serve on the examination committee, and review and pass upon the merits of the thesis/dissertation. Final approval of the membership of this Faculty Advisory Committee rests with the Vice Provost and Dean of Graduate Education.

Faculty Advisory Committees consist of at least four members, three of whom must be members of the Graduate Group and one who must be from outside the group (external member). One member is the student's faculty advisor (major professor). The faculty advisor does not necessarily need to be a member of the graduate group, and thus can be the external member, with the three remaining committee members being Graduate Group faculty. If the student would like to work with a faculty advisor outside of the Graduate Group, the student should consult first with and have approval from the Graduate Chair, then form their Faculty Advisory Committee consisting of three members of the Graduate Group faculty and their advisor who will act as the external member of the Faculty Advisory Committee. Before the student joins the group of a faculty member outside of the Graduate Group and begins research, all members of the Faculty Advisory Committee should meet with the student to formulate a research plan that is appropriate for a graduate student in the Chemistry and Biochemistry graduate program and all should agree that the faculty advisor has the necessary expertise to advise a student in conducting chemistry research. One member of the committee, who is not the faculty advisor but must be from the Graduate Group, is appointed as Chair. The external member may be a regular or adjunct faculty member from any UC campus or an individual from outside the University of California who has special expertise and qualifications. In this case, the faculty advisor should submit a brief statement indicating the appointee's affiliation and title and how the prospective appointee has special expertise or qualifications that are not represented on the campus. In addition to the justification letter from the faculty advisor, a curriculum vitae and a letter from the proposed appointee indicating a willingness to serve must be submitted to the Vice Provost and Dean of Graduate Education for review and approval. Detailed instructions are found in Graduate Policies and Procedures, at the [Graduate Division Website](#). If potential conflict of interest issues exist as defined by Graduate Division policy, an additional Oversight Member must also be appointed.

The majority of the committee (three members) should be appointed no later than the end of the second semester in residence, with the external member not required to be appointed until the advancement to candidacy exam, unless the faculty advisor is acting as the external member and in this case must be part of the committee.

Reconstitution of the committee may be justified by a substantial change in the student's thesis topic or may be required by the departure of a committee member from the university. When membership changes must be made, the faculty advisor in consultation with the student should recommend a new committee member, giving the reason for the change. The new committee members and the reason for the change must be submitted to the Vice Provost and Dean of Graduate Education.

### 3.5.2 Evaluation of Student Progress

In order to ensure satisfactory progress toward the degree, each student must meet with his or her Faculty Advisory Committee for an annual review of progress at a mutually agreeable time prior to the first day of each Fall semester. At least three members of the committee, including the faculty advisor, must be present in-person or virtually. The committee will review the student's progress toward the degree during the past year and provide feedback and recommendations. Should the committee conclude that the student is not making satisfactory progress toward the degree, the student may be placed on academic probation. The student will then be allowed a maximum of two semesters to make up the deficiencies and be returned to good academic standing. Otherwise, the student will be recommended for academic disqualification by the Vice Provost and Dean of Graduate Education unless he or she successfully petitions the Educational Policy Committee for additional time.

### 3.5.3 Grievance Procedures

Before each annual faculty committee meeting, students should fill out the mentoring survey to provide feedback about their mentoring experience with their faculty advisor. The survey results go to the Graduate Chair and the Faculty Advisory Committee Chair to help them guide the student and main faculty advisor and improve communication. Our program aims to create a supportive and positive mentoring culture and to work through conflicts before they escalate to allow students to focus on training and research.

Students or faculty advisors experiencing conflicts and wanting to discuss or report grievances are encouraged to consult with the Graduate Chair or the Faculty Advisory Committee Chair. Students may also want to use the [Graduate Division](#) or [other campus resources](#) for resolving conflicts or filing a complaint.

## 3.6. Doctoral Degree Committees:

**3.6.1 Faculty Advisory Committee:** See section 3.5.2.

**3.6.2 Candidacy Committee:** The Candidacy Committee is charged with determining the fitness of the student to proceed with the doctoral dissertation through a formal Qualifying Examination. The Candidacy Committee is the same as the Faculty Advisory Committee.

**3.6.3 Doctoral Committee:** The Doctoral Committee shall supervise the preparation and completion of the dissertation and the final examination. The Doctoral Committee is the same as the Faculty Advisory Committee. Member nominations are submitted to the Graduate Division for formal appointment in accordance with Graduate Council policy.

**3.7. Advancement to Candidacy:** All graduate students are considered resident graduates, not candidates for a degree, unless admitted to candidacy by the Graduate Division after formal application. Before advancing to candidacy for a doctoral degree, a student must have satisfied all requirements set by the graduate program, must have maintained a minimum GPA of 3.0 or higher in all course work undertaken, and must have passed unanimously the Qualifying Examination before the Candidacy Committee appointed to administer that examination. Normally, students advance by the end of the sixth semester. The student must file the appropriate paperwork (Advance to Candidacy for the Degree of Doctor Philosophy Form and Conflict of Interest Form) with the Graduate Division and pay the candidacy fee to be officially promoted to Ph.D. Candidacy.

**3.7.1. Master's "along the way" or "en route":** Students may decide to get a Master's degree "en route" to getting their Ph.D. degree. The Ph.D. qualifying exam satisfies the M.S. oral exam requirement. Therefore, once a student Advances to Candidacy, all M.S. degree requirements have been satisfied and the student need only fill out the required form from Graduate Division.

**3.8. Qualifying Examination Requirements:** Before taking the qualifying exam, students should have a passing score on the proficiency exams and at least three of the required 3-4 unit graduate courses should be completed. Passing this exam makes the student eligible for advancement to candidacy. The qualifying exam should be taken no later than the end of the fifth semester after admission to the Ph.D. program, unless the student successfully petitioned the Educational Policy Committee for an extension.

The intent of this oral examination is to ascertain the breadth of a student's comprehension of fundamental facts and principles that apply in his or her major field of study. It will also determine the student's ability to think critically about the theoretical and practical aspects of the field. Accordingly, the examination should be focused on the student's field of research but may and should venture into other areas of scholarship that underlie or impinge on the thesis topic. The examination committee is the same as the student's faculty advisory committee. Students are encouraged to discuss oral and written document expectations with their faculty advisor and committee well in advance of the exam date.

At least one week prior to the examination date, the student will provide to the committee a written document that describes his or her research topic, summarizes progress to date, and

outlines what he or she proposes to do, why it is relevant, and what will be learned. The committee conducts the examination and should include in their deliberations such factors as relevant portions of the previous academic record, performance on the examination, and an overall evaluation of the student's performance and potential for scholarly research as indicated during the examination. A unanimous decision is required for a "Pass". If not all members of the committee vote to pass, they must write a report explaining their decision and must inform the student of the reasons for the decision. Per campus regulations, exam committees must reach a decision unanimously. If need be, an exam committee can be reconstituted to ensure a unanimous decision.

A student who has not passed the examination may repeat the qualifying examination after a preparation time of no less than three and no more than nine months. The examination must be held by the same committee except that members may be replaced, with the approval of the Graduate Chair and the Vice Provost and Dean of Graduate Education, for cause such as extended absence from the campus. Students who fail to pass the examination on the second attempt will be recommended for academic disqualification, unless they successfully petition the Educational Policy Committee for an exception.

### **3.9. Dissertation Requirements:**

The Ph.D. dissertation must be creative and independent work that can stand the test of peer review. The expectation is that the material has served or will serve as the basis for peer-reviewed publication(s). The work must be the student's, and it must be original and defensible. The student is encouraged to discuss with members of the faculty committee both the substance and the preparation of the dissertation well in advance of the planned defense date.

The student must provide a copy of the dissertation to each member of the Doctoral Committee / Faculty Advisory Committee and allow each committee member at least four weeks to read and comment on it. If one or more committee members believe that there are significant errors or shortcomings in the dissertation or that the scope or nature of the work is not adequate, the student must address these shortcomings before scheduling a defense. Once the committee members are in agreement that the dissertation is ready to be defended (although minor errors or matters of controversy may still exist), the final examination date may be scheduled by the student in consultation with the committee.

The Ph.D. final examination consists of a seminar on the dissertation work, open to the public, followed by a closed examination by the Doctoral Committee. During the examination, the student is expected to explain the significance of the dissertation research, justify the methods



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employed, and defend the conclusions reached. At the conclusion of the examination, the committee shall vote on whether both the substance of the written dissertation and the student's performance on the exam are of satisfactory quality to earn a University of California Ph.D. degree. A unanimous decision is required for a pass. A student who has not passed the examination may repeat the examination after a preparation time of no less than one and no more than twelve months. A student who fails to pass the Ph.D. final examination on the second attempt will be recommended for academic disqualification to the Vice Provost and Dean of Graduate Education unless he/she successfully petitions the Educational Policy Committee for an exception.

The written dissertation itself need not be in final form at the time the final examination is passed. At the time of the final examination, the committee will point out any corrections and/or revisions to the dissertation that are needed. The members of the committee should not approve the final version of the dissertation until all required changes have been made.

Upon completion of the final examination and approval of the dissertation, the Doctoral Committee recommends, by submission of the Report on Final Examination of the Ph.D. Degree Form, the conferral of the Ph.D. subject to final submission of the approved dissertation for deposit in the University Archives. The Committee recommendation must be unanimous.

Detailed information and instructions on the submission and filing of the dissertation is available in the UCM Thesis and Dissertational Manual. A schedule of dates for filing the thesis in final form are published on the Graduate Division website in the [Dates and Deadlines section](#).

**3.10. Normative Time to Degree:** Normative Time to Advancement to Candidacy in the Chemistry and Biochemistry graduate program is four to six semesters for students who pursue the Ph.D. directly after the bachelor's degree. Normative Time in Candidacy, which are the remaining semesters recommended for completion of the dissertation, is three to six semesters.

### 3.11. Typical Timeline and Sequence of Events

Typical timeline for Ph.D. program	
Years 1-2	Pass proficiency exam Complete required TA service (minimum 1 semester) Choose faculty advisor and begin research Complete most required courses

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	Constitute and meet with faculty committee each year (usually summer)
Year 3	Complete remaining required courses Make progress in research Begin writing papers Pass advancement to candidacy exam (usually end of year 2 or in semester 5)
Year 4-5	Do research, write papers, present results at conferences Start exploring career options Meet with faculty committee each year Write and defend Ph.D. dissertation Take postdoctoral position or job in academia, industry, or government

### 3.12.Sources of Funding:

A graduate student who meets the criteria for appointment may be employed in teaching services (as a Teaching Assistant or a Teaching Fellow) for up to 12 semesters (summer appointments are excluded from these limits). Non-resident international Ph.D. students who have not advanced to candidacy are eligible to receive a Non-Resident Supplemental Tuition (NRST) Award for their first four semesters to specifically cover the NRST fee charged to their student account based on the criteria found in the Graduate Handbook, section III.F. They are also eligible for an additional two semesters of NRST award that may either be used before candidacy, or be used three or more years after advancing to candidacy (NRST is waived for the first three years post-candidacy for international students). Ph.D. students who are U.S. citizens or permanent residents classified as non-California residents are eligible only during their first two semesters of graduate study at UC Merced. Please note that NRST awards are not guaranteed and subject to available funds.

First year students are normally supported as graduate teaching assistants (TAs) during their first two semesters unless they enter the program with fellowship support. After that, students are supported as either TAs or graduate student researchers (GSRs) depending on availability of TAs and the faculty advisor's funding for GSR positions. Students who cannot be appointed as TAs because of limited English proficiency or lack of available TA positions may be appointed as GSRs for their first one or two semesters by mutual agreement of the student and the major professor. Students serving as GSRs during the academic year are appointed at 49.9% at the step for which the monthly stipend is most nearly equal to that for a first-year TA in the Natural Sciences. Students are expected to spend the remainder of

their time pursuing independent study toward the degree. GSRs do not accrue paid vacation time. Exceptions to these policies may be made at the recommendation of the student's major professor, the Graduate Group Chair, and the Vice Provost and Dean of Graduate Education, if necessary.

Students are encouraged to seek out fellowship opportunities both internal to UC Merced and external (e.g. NSF GRFP, DOE) and work with their faculty advisor to craft a solid research plan to be competitive for fellowships.

**3.13. Change of Degree Level (Ph.D. to Master's, and/or Master's to Ph.D.):** The M.S. and Ph.D. programs are two separate programs. A student in the Ph.D. program who wishes to change his/her degree objective to the M.S. must file the change of degree form with the Graduate Division. A student who has received the M.S. degree and wishes to pursue a Ph.D. must petition the Admissions Committee for admission to the Ph.D. program. When a student changes from one degree objective to another, any requirements for the new degree that have already been satisfied will be transferred. Note that passing the Ph.D. qualifying exam satisfies the M.S. oral exam requirement. If a student attempts the Ph.D. qualifying exam and does not pass, and then decides to switch to a M.S. degree, the original committee must discuss if the student's performance on the exam is satisfactory for passing the M.S. oral exam or if another exam must be held. The new M.S. exam committee need not be the same as the original Ph.D. faculty advisory committee.

## **4. General Information**

### **4.1. PELP, In Absentia and Filing Fee status.**

Information about PELP (Planned Educational Leave Program), In Absentia (reduced fees when researching out of state), and Filing Fee status can be found in the Graduate Group Policies and Procedures Handbook, available on the Graduate Division Website. International students must obtain approval from the Office of International Affairs to go on Filing Fee status.