

**Materials and Biomaterials Science and Engineering (MBSE)
Ph.D. AND M.S. DEGREE REQUIREMENTS**

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1. Introduction

1.1 Aims and Scope:

The Materials and Biomaterials Science and Engineering (MBSE) Graduate Group offers a multidisciplinary research and training program for doctoral (prioritized) and master's degrees at the forefront of the modern revolutions in materials science technology. The MBSE program delivers a highly synergistic curriculum in which students complete three courses that cover core Materials Science concepts, then choose additional electives that provide background needed for their chosen research direction. The MBSE faculty currently focus on three areas of emphases including: "Materials for Sustainability," "Materials for Biomedicine" and "Materials and Interfaces for Tailored Functionalities."

The MBSE Graduate Group strives for excellence in all aspects of graduate studies and research, including scientific quality, professional ethics, and the teaching and demonstration of precision and accuracy in communication with all audiences. Such skills will develop and maintain the trust of governmental and non-governmental scientific organizations, professional colleagues, peers, employers, mentees, and the public.

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](#). All persons seeking admission to graduate standing must submit a formal application for admission using the on-line application system available on the Graduate Division website. Applications are reviewed by the Admissions Committee and Group Chair, who make recommendations on admission to the Graduate Division. The Dean of the Graduate Division makes final decisions on admission.

There will be a rolling deadline for receipt of applications as managed by the Admissions Committee. Normally applications will be accepted for Fall semester. Enrollment in other semesters will be considered on an individual basis. Applicants are encouraged to contact individual faculty to discuss their research interests before applying for graduate study. Applicants who identify faculty members who commit to hosting and providing funding may be given priority. Students admitted on Graduate Student Research (GSR) support must be paired with a faculty advisor before admission. Students admitted as Teaching Assistants (TAs) may arrange to rotate through 2-4 faculty labs prior to assignment to a faculty advisor by the end of their first year.

Academically qualified students may also be required to complete a telephone or in-person interview with one or more of the MBSE faculty. Finally, the match of the candidate's skills and interests to MBSE research programs will be considered. For this reason, applicants are encouraged to contact participating faculty before applying, although this is not required.

Prospective graduate students should submit the following materials to <https://graduatedivision.ucmerced.edu/prospective-students/how-apply>

- The complete official application form;

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- The application fee;
- All official university/college/junior college transcripts;
- An official Graduate Record Exam (GRE) score report. Only the general tests are required;
- Three letters of recommendation from instructors or supervisors who can comment on the applicant's scholarly ability and promise as a researcher;
- Official score reports from the Test of English as a Foreign Language (TOEFL) (or IELTS) if the applicant's native language or language of instruction is other than English;
- Current curriculum vitae or resume;
- Statement of Purpose highlighting specific research interests and experience;
- Personal Statement.

The minimum requirement for MBSE Graduate Group admission requires a bachelor's degree from an accredited institution in Engineering, Physics, Chemistry, or related field. A minimum GPA of 3.0 is required. Foreign students from non-English speaking countries are required to attain a minimum score on the TOEFL or IETLS exam as required by UC Merced policy for admission to graduate programs. Admission decisions are made on a case-by case basis. Meeting some or all of these criteria does not guarantee admission, but merely eligibility. The decision to recommend admission to the Vice Provost and Dean of Graduate Education will be made by the Graduate Group Admissions Committee on the basis of available space and the competitiveness of applicants compared to the eligible pool.

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

1.2.1 Prerequisites: The following classes are considered to be prerequisites to the MBSE Graduate Program

- MSE 109: Materials Thermodynamics,
 - MSE 110: Structure and Properties of Materials, and
 - MSE 111: Kinetics and Processing of Materials;
- or courses that deliver at least this foundational knowledge.

1.2.2 Deficiencies: Coursework 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.

1.3 General Committees:

1.3.1 Executive Committee:

The Executive Committee will typically consist of four elected members (excluding the chair) with a minimum of three members (excluding the chair). Typically, the four elected members will serve rotating terms of two years. The Group Chair will serve as an *ex officio* voting member of the Committee and, therefore, is not elected to the Executive Committee, nor counted as part of the three-member minimum. It will be the responsibility of the Executive Committee to prepare an annual slate of nominees that will be put before the membership for election to serve on the Executive Committee. The nominees must be

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members of the Group, but may be either core or affiliate members. The majority of the Executive Committee members should be core members at any one time. If an affiliate is a member of the Executive Committee, that individual would have voting rights as an Executive Committee member, but not as a core member. Members can be re-elected and serve two consecutive two-year terms but must sit out one election cycle before running for a third term. In general, two individuals will be elected each year to join the two Executive Committee members who were elected the previous year and replacing the two who were elected two years previously. If one of the four members resigns, no midyear election will be needed, retaining the minimum of three members. If resignations reduce the size of the Executive Committee to fewer than three members (not counting the Group Chair), a special election will be held, defining terms to align with the goal of having continuity on the committee from year to year.

The Executive Committee (EC) shall, in consultation with the faculty, determine and implement policy for the good of the Group, establish and guide the educational requirements of the Group, and represent the interests of the Group to University and other agencies. To ensure broad participation and input every effort will be made to have EC membership from at least two Schools. The EC will make appointments to the other committees. See Article II for the EC's role in defining Graduate Group membership (both core and affiliates).

1.3.2 Admissions Committee:

The Admissions committee is charged with the development of recruiting materials for the Group, reviewing applications for admissions, making recommendations for admissions to the Dean of Graduate Studies, exploring graduate student support mechanisms, and allocating intramural financial assistance. The Admissions Committee is appointed by the Executive Committee with a composition and structure that may change from year to year depending on the needs of the Graduate Group.

1.3.3 Educational Policy Committee:

The Committee on Educational Policy (EPC) is responsible for establishing and guiding the educational programs of the Group. The EPC will be formed by the Executive committee and will conduct annual reviews of the programs. The EPC in consultation with the group faculty will determine changes in programmatic requirements of the MBSE Graduate Group.

2. Master's Degree Requirements

Students may be admitted to the MBSE graduate program to work toward an M.S. degree. The recipient of an M.S. degree will 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 MBSE group has established the following requirements for the M.S. degree. Each M.S. student must have a faculty advisor responsible for designing and approving a plan of study

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detailing all classes to be taken. Students may switch from one M.S. plan to another with the consent of an appropriate faculty advisor.

A successful Master's student must complete at least two semesters of full-time academic residence at UC Merced.

2.1. Degree Plan I- Thesis:

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. A general examination is also required.

2.1.1 Program Learning Outcomes (PLOs):

- 1) *Core Knowledge* - Possess a broad foundation in the fundamentals and current topics in materials and/or biomaterials science and engineering, as well as an in-depth understanding of their chosen research topic area.
- 2) *Technical Skills* - Exhibit the quantitative experimental and analytical skills necessary to conduct and lead independent research and contribute to knowledge in their chosen area.
- 3) *Communication Skills* - Communicate both fundamental concepts and details of their own research effectively, both in written and oral form, including in a classroom setting to expert and non-expert audiences.
- 4) *Professional Ethics* - Understand and promulgate the importance of research and professional ethics and maintaining the trust of governmental and non-governmental scientific organizations, professional colleagues, and the public.

2.1.2 Course Requirements - Core and Electives (24 units)

Masters' Plan I students must:

- Complete 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 as described below.
- Receive a grade of "A+", "A", "A-", "B+", "B", or "S" for all of the 24 units of approved courses. A course in which a student receives a "B-" or lower cannot be used to satisfy the unit requirement for the degree but will count in determining the grade point average.
- Maintain a cumulative GPA of at least 3.0. Courses graded "S/U" will not be counted in determining grade point averages.

2.1.2.1 Core Courses (14 units)

Three core 4-unit courses must be completed with satisfactory grades.

Course Number	Course Name	Units
MBSE 210	Structure of Materials	4
MBSE 211	Materials Properties	4

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MBSE 212	Thermodynamics and Kinetics	4
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Additionally, the following are also required. Note: MBSE 291 and MBSE 294 are included in the 14 units of core courses. In some cases, up to four units of MBSE 295 may be used to meet the full 24 units requirement:

Course Number	Course Name	Units
MBSE 291	Research Seminar Series	1 (at least once for each year of academic residence)
MBSE 294	Responsible Conduct of Research	1
MBSE 295	Graduate Research	As required to complete research to write thesis

2.1.2.2. Elective Courses (10 units)

Electives are selected courses from MBSE or other groups in SNS or SOE, and approved by the advisor. One 100-level course may be used to meet the 10 units of electives requirement as long as at least 20 units (of the 24 total units) are earned in 200-series graduate-level courses exclusive of credit given for thesis research and preparation (MBSE 295 and MBSE 292 may not be used for the 20 units. MBSE 294 and one unit of MBSE 291 are counted as part of the 14 units of core courses. Additional MBSE 29X courses such as MBSE 295 are not usually counted toward the 20 required units, but Special Topics courses that are taught as regular graduate-level courses – not as a course specific for the research topic – may be counted).

2.1.2.3 Summary: A minimum of 24 semester units of courses (including the three core courses and an additional 12 units) are required. Full-time students must enroll for 12 units per semester including research, academic and seminar units. Electives are chosen with the approval of the graduate advisor. Minimum requirements of MBSE 291 and MBSE 294 must also be completed. Once course requirements are completed, students may take additional classes as needed, although the 12 units per semester are generally fulfilled with a research class (MBSE 295) and Seminars (MBSE 291).

2.1.3 Special Requirements:

None

2.1.4 Advancement to Candidacy:

Except as provided in University of California Senate Regulation 694, no graduate student will be recommended for any degree except upon completing at least one year (two semesters) of academic residence at the University of California, devoted to such a course of study as the Graduate Council concerned regards as a proper year's

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work, and upon complying with such other regulations as may apply. (See Section V.A, Academic Residence Requirements, for more information on academic residence.)

In the case of the Master's degree, the terms and deadlines for formal advancement to candidacy are outlined in the Graduate Division dates and deadlines website (<https://graduatedivision.ucmerced.edu/current-students/calendar-and-deadlines>). An Application for Advancement to Candidacy initiated by the student and approved by the Graduate Group should be submitted to the Graduate Dean before the specified deadline. The application must be accompanied by petitions for any course credits that have not already been approved by the Graduate Dean. If the Master's degree requires a thesis (Plan I), membership of the thesis committee must be included, and the Graduate Group chair, and the graduate student must sign the Statement of Conflict of Interest form, which is included in the Application.

Students must be advanced to candidacy prior to degree conferral. When the student is formally advanced to candidacy, the student and the Graduate Group are notified. Please see below for information about a Master's Degree as part of the Ph.D. process using "Masters Along the way."

2.1.5 Thesis Requirements: In addition to the coursework, completion of the degree requires that students:

- Prepare a written thesis describing relevant research in the field that is read and accepted by the Thesis Committee.
- Defend the M.S. thesis via oral examination, attended and approved by the Thesis Committee.

Thesis committee meetings: The candidate and advisor should meet at least once a year with the other members of the thesis committee 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 a faculty member of the program 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 scheduled defense.

The thesis defense consists of an open seminar followed by a closed-door examination by the Thesis Committee. During the examination, the student is expected to explain the significance of the research, justify the methods employed, defend the conclusions reached, and be assessed favorably on general preparation in the discipline.

At the conclusion of the examination, the committee shall vote on whether the thesis and the student's performance on the exam are of satisfactory quality to earn a University of California M.S. degree. A unanimous vote on the outcome is required.

Possible outcomes are

- a. **Pass:** A student has passed when the Thesis Committee unanimously votes that the student passed the entire examination with scholarship that is at least acceptable. The committee must report to the Graduate Council via the

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Vice Provost and Dean of Graduate Education within 30 days. If agreed unanimously by the committee the student may be allowed to make minor modifications prior to submitting the results of the examination.

- b. **Fail:** A student has failed when the Thesis Committee votes unanimously that the student failed the entire examination. The second examination may have a format different from the first, but the substance should remain the same. A student whose performance on the second attempt is also unsatisfactory, or who does not undertake a second examination within six months, is subject to academic disqualification.
- c. **Partial pass:** A student has partially passed when the Thesis Committee votes unanimously that the student passed some components but failed others. In this instance, the following apply:
 - i. The student has the option of taking a second examination as detailed in above on the components failed; and
 - ii. The chair of the committee must write a letter to the student, with a copy to the Graduate Division, conveying the information about the student's performance (pass, fail, or partial pass) on each of the components covered during the examination.

Members of the committee may vote to make passing the exam contingent on corrections and/or revisions to the thesis. In this case, the committee will select one member, normally the graduate research advisor, who will be responsible for approving the final version of the thesis that is submitted to the Graduate Division.

All committee members must approve the thesis in its entirety and sign the title page before the thesis is submitted electronically to the Graduate Division for final approval. Should the committee determine that the thesis is unacceptable, even with substantial revisions; the program may recommend the student for disqualification from the program to the Vice Provost and Dean of Graduate Education.

The thesis must be submitted by the deadline in the semester in which the degree is to be conferred. Those students who complete requirements and submit thesis after the end of the semester and prior to the start of the subsequent semester will earn a degree for the following semester, but will not be required to pay fees for that semester. Instructions on the submission and filing of the thesis are available in the UCM Thesis and Dissertational Manual. A schedule of dates for filing the thesis in final form is published on the Graduate Division website in the [Dates and Deadlines section](#).

2.2 Degree Plan II- Non-thesis: This plan requires a minimum of 24 semester units in approved courses, at least 20 of which must be from graduate-level courses in the 200 series. A Comprehensive final examination is required. No thesis is required.

2.2.1 Program Learning Outcomes (PLOs):

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- 1) *Core Knowledge* - Possess a broad foundation in the fundamentals and current topics in materials and/or biomaterials science and engineering, as well as an in-depth understanding of their chosen research topic area.
- 2) *Communication Skills* - Communicate both fundamental concepts and details of their own research effectively, both in written and oral form, including in a classroom setting to expert and non-expert audiences.
- 3) *Professional Ethics* - Understand and promulgate the importance of research and professional ethics, and maintaining the trust of governmental and non-governmental scientific organizations, professional colleagues, and the public.

2.2.2 Course Requirements - Core and Electives (24 units)

Plan II-Non-thesis Master's Students must:

- Complete a minimum of 24 semester units in approved courses, at least 20 of which must be earned in 200-series graduate-level courses. Only courses in which the student receives grades of "A+", "A", "A-", "B+", "B", or "S" may be counted in satisfaction of the requirements for advanced degrees. A course in which a student receives a "B-" or lower cannot be used to satisfy the unit requirement for the degree but will count in determining the grade point average.
- Register for and obtain a satisfactory grade in the program's core courses, listed below
- Maintain a cumulative GPA of at least 3.0. Courses graded "S/U" will not be counted in determining grade point averages.

2.2.2.1 Core Courses (14 units)

Three core courses must be completed with satisfactory grades.

Course Number	Course Name	Units
MBSE 210	Structure of Materials	4
MBSE 211	Materials Properties	4
MBSE 212	Thermodynamics and Kinetics	4

Additionally, the following are required. Note: MBSE 291 and MBSE 294 are included in the 14 units of core courses:

Course Number	Course Name	Units
MBSE 291	Research Seminar Series	1
MBSE 294	Responsible Conduct of Research	1

2.2.2.2 Elective Courses (10 units)

Electives must be approved by the advisor. At least 10 units must be 200-level graduate courses from SNS or SOE. One 100-level course may be used to meet

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the 10 units of electives requirement as long as at least 20 total units are earned in 200-series graduate-level courses.

2.2.2.3 Summary: A minimum of 24 semester units of courses (including the core courses; 20 units must be from the 200 series) are required. Full-time students must enroll for 12 units per semester including research, academic and seminar units. Electives are chosen with the approval of the graduate advisor. Once course requirements are completed, students may take additional classes as needed.

2.2.3 Special Requirements:

None

2.2.4 Advancement to Candidacy:

Except as provided in University of California Senate Regulation 694, no graduate student will be recommended for any degree except upon completing at least one year (two semesters) of academic residence at the University of California, devoted to such a course of study as the Graduate Council concerned regards as a proper year's work, and upon complying with such other regulations as may apply. (See Section V.A, Academic Residence Requirements, for more information on academic residence.)

In the case of the Master's degree, the terms and deadlines for formal advancement to candidacy are outlined in the Graduate Division dates and deadlines website (<https://graduatedivision.ucmerced.edu/current-students/calendar-and-deadlines>). An Application for Advancement to Candidacy initiated by the student and approved by the Graduate Group should be submitted to the Graduate Dean before the specified deadline. The application must be accompanied by petitions for any course credits that have not already been approved by the Graduate Dean and must identify the committee that will administer the Comprehensive Exam.

Students must be advanced to candidacy prior to degree conferral. When the student is formally advanced to candidacy, the student and the Graduate Group are notified.

2.2.5 Comprehensive Examination:

The M.S. comprehensive examination is a written or oral test that assesses understanding of the fundamentals of Materials Science. The content of the exam represents a capstone requirement that integrates the intellectual substance of the program.

2.2.5.1 Timing: Ordinarily, the Master's Plan II students will take the Comprehensive Exam in the final semester (or the summer following the final semester).

2.2.5.2 Examination: The M.S. comprehensive examination is a 2-hour oral test that assesses general preparedness in the discipline and the content of the exam represents a capstone requirement that integrates the intellectual substance of the program. The test will be given by the committee as defined in Section 2.5.2 who will jointly determine the content of the examination, taking into account the student's specific experiences, such as the electives that were taken.

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The rubric for the Comprehensive examination will include:

The student is rated on the following scale:

(1) Mastery, (2) Developed and (3) Introductory where

(1) Mastery = proficiency expected of a PhD recipient

(2) Developed = proficiency expected of a Master's Degree recipient

(3) Introductory = proficiency expected of a Bachelor's degree recipient

Student demonstrates knowledge of the discipline:

- **Student accurately describes elements of materials/biomaterials science in the topical areas agreed upon for the examination, including an understanding of relevant literature**
- **Student answers questions demonstrating understanding of how kinetics & thermodynamics, material structure, and material properties are related to each other**
- **Student's understanding is detailed enough for the student to explain the selected topics to committee**

Student demonstrates understanding of broader impacts:

- **Student can explain how an understanding of the selected topical area(s) can be applied to provide useful products for the world to use.**
- **Student demonstrates professional and ethical behavior**

Student demonstrates communication skills:

- **Student speaks clearly using terminology appropriate for the selected topical area**
- **Student's communication follows logical patterns that enable the listener to follow and understand the concepts being presented**

2.2.5.3 Outcome: Examinations can result in either a pass or fail by unanimous consensus of the Comprehensive Examination Committee. The categories are described in Section VI. F.2 of Graduate P&P Handbook.

2.4 Advising Structure and Mentoring:

2.4.1 Advising Structure: All M.S. Plan I students in the MBSE Graduate Group must have a graduate research advisor assigned by the end of their first year (prior to admission for GSRs).

The heart of the MBSE graduate program for M.S. Plan I students is the completion of a piece of original scientific research leading to the preparation and defense of a thesis. To this end, each student should discuss research interests and possible projects with faculty in the group as early as possible, and select a graduate research advisor early during the first year of study, preferably by the end of the first semester. Selection of a graduate research advisor must be approved by the Graduate Group and must occur before the student's Faculty Committee can be constituted. The student and the graduate research advisor together will develop a research topic, and research will normally occupy a majority of the student's time after the first year of residence.

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Interdisciplinary projects are highly encouraged, as are research collaborations with faculty or senior scientists outside UC Merced. However, the graduate research advisor must be a member of the MBSE Graduate Group. Students will be assigned an initial advisor when they first enroll, unless the student has already chosen an advisor.

Students may perform rotations during their first year of graduate studies. Rotations are 8 weeks long each with 2 rotations occurring during the first semester, and, if needed, up to 2 more rotations can be considered for the second semester. A maximum of 4 rotations is permitted.

2.4.2 Evaluation of Student Progress: After their first year of graduate study, M.S. Plan I students must schedule annual reviews with their Faculty Committee (see section 2.5), during which they evaluate the progress made during the prior year, discuss any areas that need improvement, identify upcoming milestones towards the degree objective, and outline plans for specific research objectives in the next year. It is the student's responsibility to submit the completed annual review form to the graduate support staff for proper filing of the document.

Graduate students are expected to maintain satisfactory progress as defined by the faculty of the program, and in accordance with the Policies and Procedures for the student's Graduate Group, and policies of the Graduate Council and UC Merced. Satisfactory progress is determined on the basis of both the student's recent academic record and overall performance. A graduate student who has not demonstrated satisfactory academic progress may be subject to academic disqualification. Further details regarding definitions of satisfactory progress, unsatisfactory progress, and grounds and procedures for academic disqualification may be found in the UC Merced Graduate Policies and Procedures Handbook, available on the Graduate Division website:

https://graduatedivision.ucmerced.edu/sites/graduatedivision.ucmerced.edu/files/page/documents/graduate_policies_and_procedures_handbook_ay20-21_ucmerced_published.pdf.

More specifically, satisfactory progress is defined as:

Graduate 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, or who is judged not to be making satisfactory progress toward the degree by his or her graduate advisor or faculty committee, 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 dismissed from the graduate program.

1 Only courses in the 200 series in which the student receives grades of "B" or above, or "S" may be counted in satisfaction of the requirements for advanced degrees. A

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course in which a student receives a “C” or “D” or lower cannot be used to satisfy the unit requirement for the degree but will count in determining the grade point average.

2 Candidates must maintain an average of at least three grade points per unit in all upper division and graduate courses elected during their residence as graduate students at the University of California. Students must maintain an average grade point of 3.0 for advancement to candidacy and conferral of the degree.

3 Courses graded “S/U” will not be counted in determining grade point averages.

Each student should discuss research interests and possible Ph.D. projects with faculty in the group as early as possible, and select a graduate research advisor by the end of the first year of study. A student without an advisor by the end of their first year, is considered to not be making satisfactory progress.

Students must make satisfactory progress on their programs of study as determined by their graduate advisor.

2.5 Master’s Degree Committees:

2.5.1 Thesis Committee:

The student, in consultation with the advisor, the Graduate Group, and other faculty, recommends appointment of a Faculty Committee to advise on and supervise the student’s thesis or dissertation research, serve on examination committees, and review and pass upon the merits of the thesis or dissertation. Final approval of committee membership rests with the Vice Provost and Dean of Graduate Education.

The Faculty Committee in the MBSE group, which also serves as the Thesis Committee for the M.S. Plan I, or as the Qualifying Examination and Doctoral Committee for the Ph.D., typically consists of four members, with a minimum of three members, although additional committee members are permitted if warranted by the student’s research project. One is the student’s graduate research advisor, one should be a Senate faculty member who holds a core membership outside the MBSE group, and the rest are typically MBSE Senate faculty members (one of whom is appointed as Committee Chair). Under some circumstances one of the committee members can be a Senate 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 graduate research 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 graduate advisor, a curriculum vitae and a letter or email from the proposed appointee indicating a willingness to serve must be submitted to the Chair of the MBSE Graduate Group and then the Vice Provost and Dean of Graduate Education for review and approval.

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The Advisor's primary role during all committee meetings is to add depth to the review. The Committee should work as a team to assess the student's progress, challenging the student to answer difficult questions without being confrontational. The Advisor is encouraged to ask probing questions, but the purpose of the committee meetings is to establish the competency level of the student, so if the Advisor answers questions on behalf of the student, this must be viewed as a competency deficiency on the part of the student.

Nominations for the thesis committee are submitted to the Vice Provost and Dean of Graduate Education for formal appointment in accordance with Graduate Council policy; Qualifying Examination Committees are appointed by the Graduate Group.

2.5.2 Comprehensive Examination Committee:

The student, in consultation with his/her graduate advisor and Graduate Group chair, nominate typically a total of three or four faculty to serve on the Comprehensive Examination Committee. Additional committee members are permitted if warranted by the student's research project. Of the three or four, typically one is the student's graduate research advisor, one should be a Senate faculty member who holds a core membership outside the MBSE group, and the rest are MBSE Senate faculty members (one of whom is appointed as Committee Chair). Under some circumstances one of the committee members can be a Senate 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 graduate research 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 graduate advisor, a curriculum vitae and a letter from the proposed appointee indicating a willingness to serve must be submitted to the Chair of the MBSE Graduate Group and then the Vice Provost and Dean of Graduate Education for review and approval.

These nominations are submitted to the Graduate Division for formal appointment in accordance with Graduate Council policy. This committee of faculty members shall approve the subject, pass on the content of examination, and administer the examination.

All members of the committee must be in attendance (either in person or remotely) for the M.S. oral thesis exam. 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. Reconstitution of the committee may also 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 graduate advisor in consultation with the student should recommend a new committee member, giving the reason for the change. The change must be reviewed and approved by the Chair of the MBSE Graduate Group and the Vice Provost and Dean of Graduate Education.

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2.6 Normative Time to Degree: Nominally, a student advances to candidacy and completes the Master's Degree within 2 years. Extensions beyond these limits can be permitted by the Executive Committee.

2.7 Typical Timeline and Sequence of Events:

General timelines for Master's students Plan 1:

Year/Semester	Activities
Year 1 (Semesters 1,2)	Learn about research
	Take classes
Summer 1	Begin full time research with Master's advisor
Year 2 (Semesters 3,4)	Continue full time research with Master's advisor
	Take one class per semester if necessary
	Assemble faculty committee (beginning of third semester)
	Prepare manuscripts for publication
	Present work at a scientific conference; network for career
	Defend and publish dissertation

For example: for Master's Plan 1:

<i>Year One</i>	<i>Fall</i>	<i>Spring</i>
	MBSE 210 Structure of Materials (4)	MBSE 212: Thermodynamics and Kinetics (4)
	MBSE 211: Materials Properties (4)	Elective (4)
	MBSE 294: Responsible Conduct in Research (1)	MBSE 295: Graduate Research (4)
	MBSE 291: Research Seminar Series (1)	
	MBSE 295: Graduate Research (2)	
<i>Year Two</i>	<i>Fall</i>	<i>Spring</i>
	Elective (4)	Elective (4)
	MBSE 291: Research Seminar Series (1)	
	MBSE 295: Graduate Research (3)	MBSE 295: Graduate Research (8)
	<i>Thesis Preparation</i>	Complete M.S. Thesis and Pass Oral Thesis Defense

General timeline for Master's Plan II students:

Year/Semester	Activities
Year 1 (Semesters 1,2)	Complete coursework and pass Comprehensive Exam

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For example, for Master's Plan II:

<i>Year One</i>	<i>Fall</i>	<i>Spring (or summer)</i>
	MBSE 210 Structure of Materials (4)	MBSE 212: Thermodynamics and Kinetics (4)
	MBSE 211: Materials Properties (4)	Elective (4)
	Elective (3)	Elective (4)
	MBSE 291: Research Seminar Series (1)	Comprehensive exam
	MBSE 294: Responsible Conduct in Research (1)	

Note: students may complete the Masters in two years if preferred.

Individual course plans vary depending on the interests of the student. Students choose elective courses in consultation with their faculty advisors. Students largely enroll in MBSE courses, though they may also choose to enroll in graduate courses offered through QSB, ME, Math, Physics, and Chemistry.

A student who was admitted to the Master's degree program may be considered by the MBSE Graduate Group for subsequent admission to Ph.D. status. The committee may require the student to submit new letters of recommendation, a revised statement of purpose, or other appropriate information, depending on the situation. The process is internal to MBSE Graduate Group until a decision is made. The Chair of the MBSE Graduate Group must approve the Change of Degree form. The form must be submitted to the Graduate Division along with the Graduate Group's decision. If the Graduate Group accepts the student for doctoral studies, the Graduate Dean has the authority to approve and formally recognize the change to doctoral status. Only at that time will the student be eligible to register as a doctoral student. International students may have additional visa sponsorship requirements if they change from one degree level to another, and should check with the Office of International Affairs.

2.8 Sources of Funding: Financial support for Master's Degree students will be addressed on a case-by-case basis – it is usually expected that Master's students are self-funded.

3. Doctoral Degree Requirements

The Doctor of Philosophy degree is granted to students who demonstrate a thorough knowledge of a broad field of learning and have given evidence of distinguished accomplishment in that field. The degree also signifies that the recipient has critical ability and powers of imaginative synthesis as demonstrated by a doctoral dissertation containing an original contribution to knowledge in his or her chosen field of study.

In addition to the course and other requirements listed below, Ph.D. students must

- Complete at least six semesters of full-time academic residence at UC Merced. If a student enters the program with a Master's Degree, only three semesters are required.
- Complete at least 12 units of MBSE 295: Graduate Research.

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- Serve as a Teaching Assistant for at least one semester.
- Give two open technical seminars: either on campus or at a professional conference.
- Present a written dissertation project proposal for approval, and pass an oral qualifying exam on specific competence to pursue the proposed dissertation topic and general preparedness in the discipline, administered by the Qualifying Exam Committee.
- Present a doctoral dissertation containing an original contribution to knowledge in the field for approval, and successfully defend it during a final oral examination, administered by the Doctoral Committee.

Students whose degree objective is a Ph.D. but who wish to also receive an M.S. from UC Merced must complete all requirements for an M.S. degree, either Plan I or II, in addition to the requirements for the Ph.D. degree. Students that have taken lettered graduate level courses for an MS degree that can be mapped directly onto the MBSE required or elective courses and earned a grade indicating mastery of the course materials, may petition up to a maximum of 16 course units, not including any seminars and research credits, to count toward Ph.D. requirements which in-essence reduces their course load for the Ph.D., as described below.

3.1 Program Learning Outcomes (PLOs):

- 1) *Core Knowledge* - Possess a broad foundation in the fundamentals and current topics in materials and/or biomaterials science and engineering, as well as an in-depth understanding of their chosen research topic area.
- 2) *Technical Skills* - Exhibit the quantitative experimental and analytical skills necessary to conduct and lead independent research and contribute to knowledge in their chosen area.
- 3) *Research Competency* - Be able to identify new, important, and interesting research opportunities, and be able to develop effective strategies, including the experimental plan, for pursuing these opportunities.
- 4) *Communication Skills* - Communicate both fundamental concepts and details of their own research effectively, both in written and oral form, including in a classroom setting to expert and non-expert audiences.
- 5) *Critical Thinking* - Be able to critically evaluate the experimental design, data analysis and data interpretation of our peers.
- 6) *Professional Ethics* - Understand and promulgate the importance of research and professional ethics, and maintaining the trust of governmental and non-governmental scientific organizations, professional colleagues, and the public.

3.2 Course Requirements - Core and Electives (24 units)

Ph.D. students must:

- Complete 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 as described below.

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- Receive a grade of “A+”, “A”, “A-”, “B+”, or “B”, for all of the 24 units of approved courses. A course in which a student receives a “B-” or lower cannot be used to satisfy the unit requirement for the degree but will count in determining the grade point average
- Maintain a cumulative GPA of at least 3.0. Courses graded “S/U” will not be counted in determining grade point averages.
- Complete the Core Competency Examination.

Students entering with graduate-level course credit obtained from another university or program (e.g. having obtained a Masters) may petition the MBSE Education Committee to waive course requirements. The Committee will consider the rigor of the courses completed, the grades obtained, and evidence that the student has a foundational knowledge of Materials Science. Normally, up to 16 units can be waived with the approval of the MBSE Education Committee (for graduate courses taken at other institutions or other programs).

3.2.1 Core Courses (14 units)

Three core courses must be completed with satisfactory grades:

Course Number	Course Name	Units
MBSE 210	Structure of Materials	4
MBSE 211	Materials Properties	4
MBSE 212	Thermodynamics and Kinetics	4

Additionally, the following courses are required. Note: MBSE 291 and MBSE 294 are included in the 14 units of core courses. In some cases, up to four units of MBSE 295 may be used to meet the full 24 units requirement:

Course Number	Course Name	Units
MBSE 291	Research Seminar Series	1 (at least once for each year of academic residence)
MBSE 294	Responsible Conduct of Research	1
MBSE 295	Graduate Research	At least 8

3.2.2 Elective Courses (10 units)

Electives are selected courses from MBSE or other groups in SNS or SOE, and approved by the advisor. One 100-level course may be used to meet the 10 units of electives requirement as long as at least 20 units (of the 24 total units) are earned in 200-series graduate-level courses exclusive of credit given for dissertation research and preparation (MBSE 295 and MBSE 292 may not be used for the 20 units. MBSE 294 and one unit of MBSE 291 are counted as part of the 14 units of core courses. Additional MBSE 29X courses such as MBSE 295 are not usually counted toward the 20 required units, but Special Topics courses that are taught as regular graduate-level courses – not as a course specific for the research topic – may be counted).

3.2.3 Summary:

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A minimum of 24 semester units of courses (including the three core courses and an additional 12 units) are required. Full-time students must enroll for 12 units per semester including research, academic and seminar units. Electives are chosen with the approval of the graduate advisor. Minimum requirements of MBSE 291, MBSE 294 and MBSE 295 must also be completed. Once course requirements are completed, students may take additional classes as needed, although the 12 units per semester are generally fulfilled with a research class (MBSE 295) and Seminars (MBSE 291).

3.3 Special Requirements:

3.3.1 Teaching Requirement: All graduate students pursuing the Ph.D. are required to serve as a Teaching Assistant for at least one semester.

3.3.2 Core Competency Examination: Each student must demonstrate competency in the core areas of materials science by passing this exam. It will be offered as a written exam at the end of each academic year and will be reviewed/updated each year by the instructors of the three core courses and by other interested MBSE faculty.

Students will ordinarily take the exam at the end of their first academic year, but for a student in special circumstances (such as starting in January), the Graduate Chair (in consultation with the Education Committee, if appropriate) may approve the student taking it at the end of the second year. A student who does not pass the written exam must take a follow-up oral exam from the Education Committee before the subsequent fall semester begins. The content of the oral exam will be based on concepts tested in the prior written exam, at the discretion of the Education Committee. A student who fails the oral exam will be moved into the Masters program.

3.4 Dissertation Plan: A minimum of six 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. For the purposes of determining residency, only the Fall and Spring semester will be counted; however, the summer semester may be counted in evaluating students on academic probation. 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, and upon completing all preparatory work and demonstrating readiness to proceed to the dissertation phase.

3.5 Advising Structure and Mentoring:

3.5.1 Advising Structure: The heart of the MBSE graduate program for Ph.D. students is the completion of a piece of original scientific research leading to the preparation and defense of dissertation. To this end, each student should discuss research interests and possible projects with faculty in the group as early as possible, and select a graduate research advisor early during the first year of study, preferably by the end of the first semester. Selection of a graduate research advisor must be approved by the Graduate

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Group and must occur before the student's Faculty Committee can be constituted. The student and the graduate research advisor together will develop a research topic, and research will normally occupy a majority of the student's time after the first year of residence. Interdisciplinary projects are highly encouraged, as are research collaborations with faculty or senior scientists outside UC Merced. However, the graduate research advisor must be a member of the MBSE group. Students will be assigned an initial advisor when they first enroll, unless the student has already chosen an advisor.

Students may perform rotations during their first year of graduate studies. Rotations are 8 weeks long each with 2 rotations occurring during the first semester, and, if needed, up to 2 more rotations can be considered for the second semester. A maximum of 4 rotations is permitted.

The Graduate Advisor is the faculty member who supervises the student's research and dissertation. The Graduate Chair, who is appointed by the Vice Provost and Dean of Graduate Education, is a resource for information on academic requirements, policies and procedures, and registration information until the Doctoral Committee is formed. The Graduate Group Coordinator assists students with identifying appointments and general university policies.

3.5.2 Evaluation of Student Progress: After their first year of graduate study, Ph.D. students must schedule reviews with their Faculty Committee, during which they evaluate the progress made during the prior year, discuss any areas that need improvement, identify upcoming milestones towards the degree objective, and outline plans for specific research objectives in the next year.

Graduate students are expected to maintain satisfactory progress as defined by the faculty of the program, and in accordance with the Policies and Procedures for the student's Graduate Group, and policies of the Graduate Council and UC Merced. Satisfactory progress is determined on the basis of both the student's recent academic record and overall performance. A graduate student who has not demonstrated satisfactory academic progress may be subject to academic disqualification. Further details regarding definitions of satisfactory progress, unsatisfactory progress, and grounds and procedures for academic disqualification may be found in the UC Merced Graduate Policies and Procedures Handbook, available on the Graduate Division website.

https://graduatedivision.ucmerced.edu/sites/graduatedivision.ucmerced.edu/files/page/documents/graduate_policies_and_procedures_handbook_ay20-21_ucmerced_published.pdf

More specifically, satisfactory progress is defined as:

Graduate 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, or who is judged not to be making satisfactory progress toward the degree by his or her graduate advisor or faculty committee, will be placed on academic probation. The student will then be

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allowed a maximum of two semesters to make up the deficiencies and be returned to good academic standing. Otherwise, the student will be dismissed from the graduate program.

Specific scholarship requirements are as follows:

- 1 Only courses in the 200 series in which the student receives grades of “B” or above, or “S” may be counted in satisfaction of the requirements for advanced degrees. A course in which a student receives a “C” or “D” or lower cannot be used to satisfy the unit requirement for the degree but will count in determining the grade point average.
- 2 Candidates must maintain an average of at least three grade points per unit in all upper division and graduate courses elected during their residence as graduate students at the University of California. Students must maintain an average grade point of 3.0 for advancement to candidacy and conferral of the degree.
- 3 Courses graded “S/U” will not be counted in determining grade point averages.
- 4 Each student should discuss research interests and possible Ph.D. projects with faculty in the group as early as possible, and select a graduate research advisor by the end of the first year of study. A student without an advisor by the end of their first year, is considered to not be making satisfactory progress.

Students must make satisfactory progress on their programs of study as determined by their graduate advisor.

3.6 Doctoral Degree Committees:

The Faculty Committee serves as the Qualifying Examination and Doctoral Committee for the Ph.D., typically consists of four members, with a minimum of three members, although additional committee members are permitted if warranted by the student’s research project. One is the student’s graduate research advisor, one should be a Senate faculty member who holds a core membership outside the MBSE group, and the rest are typically MBSE Senate faculty members (one of whom is appointed as Committee Chair). Under some circumstances one of the committee members can be a Senate 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 graduate research 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 graduate advisor, a curriculum vitae and a letter or email from the proposed appointee indicating a willingness to serve must be submitted to the Chair of the MBSE Graduate Group and then the Vice Provost and Dean of Graduate Education for review and approval.

All members of the committee must be in attendance (either in person or remotely) for the Ph.D. oral qualifying examination and dissertation defense. If a committee member’s absence from campus for an extended period of time makes scheduling of examinations unreasonably

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difficult, the student may request that the committee be reconstituted. Reconstitution of the committee may also 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 graduate advisor in consultation with the student should recommend a new committee member, giving the reason for the change. The change must be reviewed and approved by the Chair of the MBSE Graduate Group and the Vice Provost and Dean of Graduate Education.

3.6.1 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 Committee structure is described above.

The student, in consultation with her/his graduate advisor, nominates three faculty to serve on the Candidacy Committee. These nominations are submitted to the Graduate Group Chair for formal appointment in accordance with Graduate Council policy. The Application for Qualifying Examination available on the Graduate Division website must be submitted one month prior to the proposed examination date. Students must be in good academic standing and registered for the semester in which the examination is held. The Candidacy Committee conducts the exam and submits results to the Graduate Division using the Qualifying Examination Report Form.

The Advisor's primary role during all committee meetings is to add depth to the review. The Committee should work as a team to assess the student's progress, challenging the student to answer difficult questions without being confrontational. The Advisor is encouraged to ask probing questions, but the purpose of the committee meetings is to establish the competency level of the student, so if the Advisor answers questions on behalf of the student, this must be viewed as a competency deficiency on the part of the student.

3.6.2 Doctoral Committee: The Doctoral Committee shall supervise the preparation and completion of the dissertation and the final examination. The Doctoral Committee is a three-member committee selected by Candidacy Committee, in consultation with the graduate student, the doctoral committee chair (usually the graduate advisor), and the Graduate Group Chair, on the Advancement to Candidacy for the Degree of Doctor of Philosophy Form. The majority of the committee should be affiliated with the program. The role of the Doctoral Committee is to advise the doctoral student on the research topic and methods, and then to review the final completed dissertation for acceptance. The Doctoral Committee Chair should determine the desires of the individual members regarding assistance with the research and dissertation review at the time the doctoral committee is constituted. Students are expected to meet with the Chair of their doctoral committee regularly. Doctoral committee members are expected to read and comment on a dissertation within four weeks from its submission. The student and faculty will coordinate a timeline for the student to present the thesis to the doctoral committee. This timeline must allow all doctoral committee members enough time to fulfill their responsibilities within the indicated deadline.

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3.7 Advancement to Candidacy: 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 in all course work undertaken, must have passed the Core Competency Examination, and must have passed unanimously the Qualifying Examination before the Candidacy Committee appointed to administer that examination. Upon successful completion of that examination (including the dissertation project proposal and oral qualifying examination), the student will fill out and submit an application for advancement to candidacy. After the application is signed by the graduate research advisor and Graduate Group chair, the student pays a candidacy fee and submits the form to the Graduate Division for review and approval. The candidate and graduate program will be notified of formal advancement and the appointment of a Doctoral Committee. Advancement to Candidacy begins with the first academic term following completion of all requirements (including submission of all forms). Upon advancement to candidacy for the degree, the Faculty Committee serves as the Doctoral Committee, which is then charged to guide the student in research and in the preparation of the dissertation.

Masters Along the way

At the time of advancement to candidacy, Ph.D. students in the Materials and Biomaterials Science and Engineering Ph.D. program that have not previously earned a master's degree in Materials and Biomaterials Science and Engineering or similar discipline may obtain a master's degree while working toward the Ph.D. degree. Students must get the approval of their faculty advisor. The master's degree and the Ph.D. degree may not be conferred in the same term. Actions that are required to obtain the Masters Along the way include:

- Pass the Qualifying Exam for the Ph.D. and complete all course requirements for the Master's degree Plan I.
- At the time of Advancement to Candidacy for the Ph.D., indicate on the form the intent to receive the master's degree.
- Apply for graduation for the Master's Degree (Plan II, unless the proposal for the Qualifying Exam was submitted as a Master's Thesis that could be published, in which case the degree would be Plan I) with the Registrar's office once the Advancement to Candidacy for the Ph.D. has been processed.

3.8 Qualifying Examination Requirements

3.8.1 Qualifying Examination

i. General Information

All students will complete all course requirements before taking their Qualifying Examination. Passing this exam makes the student eligible for advancement to candidacy. The qualifying exam should be taken no later than the end of the second year after starting the Ph.D. program.

The Qualifying Examination should evaluate both general preparedness in the discipline, and specific competence to pursue the proposed dissertation topic. In its deliberation, the Committee ordinarily will review the student's academic record and faculty evaluations. The Committee may conduct any other examination it deems appropriate. The Committee ordinarily will review an outline of the proposed

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dissertation project, and will determine by oral examination the student's competence in that area. When, by unanimous vote, the Committee decides the student is qualified for the dissertation phase, it shall recommend advancement to candidacy by filing the Qualifying Examination Report so that the results can be reported to the Graduate Council via the Vice Provost and Dean of Graduate Education. Following its formal appointment, the Committee is free to adopt whatever procedures it deems appropriate to conduct the Qualifying Examination for candidacy, subject to the rules of the Graduate Program:

- Administration of the Candidacy Examination must conform to the policies established by the Graduate Council.
- The student must be given adequate notice of the content, form and time of the examination.
- The Committee must meet to decide upon the procedures to be followed, and the student given an opportunity to comment upon the selected procedures.

ii. Conduct of the Exam

The student will provide to the Qualifying Examination Committee a written dissertation project proposal 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 Qualifying Examination Committee will receive this document no later than 4 weeks before the scheduled oral qualifying exam. The oral exam will include two parts: a presentation of the proposed dissertation research and assessment of the candidate's competence to pursue it, and a structured oral examination on graduate course materials (based on results of the core-competency exam) and topics related to the proposed research. The student must be registered in the semester of the examination.

Although the formal Qualifying Examination for candidacy ordinarily is conducted in a single day, the Committee may meet intermittently over a longer period, and may decide to reexamine the student on one or more topics after a specified interval. When the Committee meets to conduct the oral Qualifying Examination, it must file the Qualifying Examination Report so that the results are reported to the Graduate Council via the Vice Provost and Dean of Graduate Education within 30 days. Upon completion of the qualifying examination and all other Graduate Group requirements for Advancement to Candidacy, the results should be submitted to the Graduate Division on the Qualifying Examination Report Form. The Qualifying Examination Report Form must be signed by all committee members at the time the candidacy examination is concluded and submitted even if the student failed the examination.

The primary advisor may participate in the oral exam and provide information to the committee. The advisor is encouraged to ask probing questions, but the purpose of the exam is to establish the competency level of the student, so if the advisor answers questions on behalf of the student, this must be viewed as a competency deficiency on the part of the student.

iii. Outcome of the Exam

Before voting upon its recommendation for or against candidacy, the Committee, as a whole, shall meet with the student, and any member of the Committee will have the

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right to pose appropriate questions to the student. The Committee must conclude its examination when convened with the student present. The committee, having reached a unanimous decision, shall inform the student of its decision to:

- Pass- A student has passed when the Qualifying Examination Committee unanimously votes that the student passed the entire examination with scholarship that is at least acceptable. The committee must report to the Graduate Council via the Vice Provost and Dean of Graduate Education within 30 days. If agreed unanimously by the committee the student may be allowed to make minor modifications prior to submitting the results of the examination.
- Fail- A student has failed when the Qualifying Examination Committee votes unanimously that the student failed the entire examination. The second examination may have a format different from the first, but the substance should remain the same. A student whose performance on the second attempt is also unsatisfactory, or who does not undertake a second examination within a reasonable period of time, is subject to academic disqualification.
- Partial Pass- A student has partially passed when the Qualifying Examination Committee votes unanimously that the student passed some components but failed others. In this instance, the following apply:
 - The student has the option of taking a second examination as detailed in above on the components failed; and
 - The chair of the committee must write a letter to the student, with a copy to the Graduate Division, conveying the information about the student's performance (pass, fail, or partial pass) on each of the components covered during the examination.

If a unanimous decision takes the form of "Partial Pass" or "Fail", the Chair of the Candidacy 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.

3.9 Dissertation Requirements: The Ph.D. dissertation must be a creative and independent work that can stand the test of peer review. The expectation is that the material will serve as the basis for publication(s) in peer-reviewed journals. The student is encouraged to discuss both the substance and the preparation of the dissertation with members of the Doctoral Committee well in advance of the planned oral examination date. Usually, the committee consists of three members, two of whom are from the major area and one from a different area.

The student must provide a copy of the dissertation to each member of the Doctoral Committee and allow each committee member at least four weeks to read and comment on it. If one or more committee members believe that significant errors or shortcomings exist in the dissertation, or that the scope or nature of the work is not adequate, the student must address these shortcomings before scheduling the dissertation defense. Once the committee members are in agreement that the dissertation is ready for the defense, it may be scheduled by the student in consultation with the committee. The date must be reported to the Dean of Graduate Studies, and one copy of the dissertation filed, no later than three weeks before

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the proposed date of the defense.

The Ph.D. dissertation defense consists of an open seminar on the dissertation work followed by a closed-door examination by the Doctoral Committee. During the examination, the student is expected to explain the significance of the dissertation research, justify the methods employed, and defend the conclusions reached. At the conclusion of the examination, the committee shall vote on whether both the written dissertation and the student's performance on the oral exam are of satisfactory quality to earn a University of California Ph.D. degree. A unanimous vote on the outcome is required.

3.9.1 Final Examination

A final oral examination is an integral part of the Doctoral Committee's review of the dissertation, see section c. Dissertation.

3.9.2 General Requirements

The submission of the dissertation is the last step in the program leading to the award of an advanced degree. All dissertations submitted in fulfillment of requirements for advanced degrees at UCM must conform to certain University regulations and specifications with regard to format and method of preparation. The UCM Thesis and Dissertation Manual are available at the Graduate Division website. The Doctoral Committee certifies that the completed dissertation is satisfactory through the signatures of all Committee members on the signature page of the completed dissertation. The doctoral committee chair is responsible for the content and final presentation of the manuscript.

Filing instructions are found in the UCM Thesis and Dissertation Manual. The advanced degree manuscript is expected to be submitted by the deadline in the semester in which the degree is to be conferred. The end of the semester is the deadline for submitting dissertations during each semester. Those students who complete requirements and submit dissertations after the end of the semester and prior to the start of the subsequent semester will earn a degree for the following semester, but will not be required to pay fees for that semester. In accordance with UC and UCM policy, all approved thesis/dissertation manuscripts automatically become available for public access and circulation as part of the UC Libraries collections.

3.9.3 Dissertation

The research conducted by the student must be of such character as to show ability to pursue independent research. The dissertation reports a scholarly piece of work of publishable quality that solves a significant scientific problem in the field and is carried out under the supervision of a member of the program while the student is enrolled in the program. The chair of the doctoral committee must be a member of the program and must be immediately involved with the planning and execution of the experimental work done to formulate the dissertation.

Students should meet regularly with their dissertation committee. The dissertation must be submitted to each member of the dissertation committee at least one month before

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the student expects to make the defense. Informing committee members of progress as writing proceeds helps the members to plan to read the dissertation and provide feedback. The dissertation must be approved and signed by the dissertation committee before it is submitted to Graduate Division for final approval.

Before voting upon its recommendation for or against candidacy, the Committee, as a whole, shall meet with the student, and any member of the Committee will have the right to pose appropriate questions to the student. The Committee must conclude its examination when convened with the student present. The committee, having reached a unanimous decision, shall inform the student of its decision to:

- Pass- A student has passed when the Qualifying Examination Committee unanimously votes that the student passed the entire examination with scholarship that is at least acceptable. The committee must report to the Graduate Council via the Vice Provost and Dean of Graduate Education within 30 days. If agreed unanimously by the committee the student may be allowed to make minor modifications prior to submitting the results of the examination.
- Fail- A student has failed when the Qualifying Examination Committee votes unanimously that the student failed the entire examination. The second examination may have a format different from the first, but the substance should remain the same. A student whose performance on the second attempt is also unsatisfactory, or who does not undertake a second examination within a reasonable period of time, is subject to academic disqualification. A third examination may be given only with the approval of the Graduate Group committee and the Vice Provost and Dean of Graduate Education.
- Partial Pass- A student has partially passed when the Qualifying Examination Committee votes unanimously that the student passed some components but failed others. In this instance, the following apply:
 - The student has the option of taking a second examination as detailed in above on the components failed; and
 - The chair of the committee must write a letter to the student, with a copy to the Graduate Division, conveying the information about the student's performance (pass, fail, or partial pass) on each of the components covered during the examination.

If a unanimous decision takes the form of "Partial Pass" or "Fail", the Chair of the Candidacy 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.

Members of the committee may vote to make passing the exam contingent on corrections and/or revisions to the dissertation. In this case, the committee will select one member, normally the graduate research advisor, who will be responsible for approving the final version of the dissertation that is submitted to Graduate Division. All members of the dissertation committee must sign the final dissertation.

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3.10 Normative Time to Degree: We anticipate that students will advance to candidacy at the end of the second year and complete their degree within three years of advancing to candidacy.

3.11 Typical Timeline and Sequence of Events

General Timeline for Ph.D. students:

Year/Semester	Activities
Year 1 (Semesters 1,2)	Learn about research
	Take classes
	Pass Core Competency Examination
	Complete first annual examination with tentative committee
Summer 1	Begin full time research with Ph.D. advisor
Year 2 (Semesters 3,4)	Continue full time research with Ph.D. advisor
	Take one class per semester if necessary
	Assemble faculty committee (beginning of third semester)
	Prepare for qualifying exam
	Schedule qualifying exam (during fourth semester) – defend Ph.D. research proposal
	Apply for candidacy after passing qualifying exam (end of fourth semester)
Years 3 (Semesters 5,6)	Conduct research
	Prepare manuscripts for publication
	Present work at a scientific conference; network for career
Years 4 (Semesters 7,8)	Conduct research
	Continue publishing manuscripts
	Present work at a scientific conference; network for career.
Year 5 (Semesters 9,10) if applicable	Conduct research
	Present work at a scientific conference; network for career
	Declare candidacy for graduation (ninth semester)
	Defend and publish dissertation (tenth semester)

For example, Ph.D. students may follow:

<i>Year One</i>	<i>Fall</i>	<i>Spring (first year exam completed)</i>
	MBSE 210 Structure of Materials (4)	MBSE 212: Thermodynamics and Kinetics (4)
	MBSE 211: Materials Properties (4)	Elective (4)
	MBSE 294: Responsible Conduct in Research (1)	MBSE 295: Graduate Research (4)
	MBSE 291: Research Seminar Series (1)	
	MBSE 295: Graduate Research (1)	
<i>Year Two</i>	<i>Fall</i>	<i>Spring (advancement to Ph.D. candidacy)</i>
	MBSE 2XX: Technical	

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	Elective (4)	
	MBSE 291: Research Seminar Series (1)	
	MBSE 295: Graduate Research (7)	MBSE 295: Graduate Research (12)
<i>Year Three</i>	<i>Fall</i>	<i>Spring</i>
	MBSE 291: Research Seminar Series (1)	Open Technical Seminar
	MBSE 295: Graduate Research (11)	MBSE 295: Graduate Research (12)
<i>Year Four-Five</i>	<i>Fall</i>	<i>Spring</i>
	MBSE 291: Research Seminar Series (1)	
	MBSE 295: Graduate Research (11)	MBSE 295: Graduate Research (12)
		Complete and defend dissertation

3.12 Sources of Funding: To the extent available resources allow, financial support will be provided for Ph.D. students, and is normally offered as stipend support in the form of appointment as either Teaching Assistants (TAs) or Graduate Student Researchers (GSRs). Students in their first semester of residence usually serve as TAs for appropriate courses in the schools of Natural Sciences or Engineering. After the first semester, support may be offered through either funding as a TA or a GSR in the graduate research advisor's laboratory. TA stipends are set by the schools while GSR stipends are determined by the Graduate Group. Graduate students with external fellowships are still required to satisfy the one semester teaching requirement and will be paid by the school for this teaching.

While every effort will be made to provide employment as a TA or GSR for Ph.D. students in residence, admission to graduate study carries no guarantee of financial support.

Following advancement to candidacy, doctoral students who are not California residents will have their Nonresident Tuition reduced by 100 percent for a maximum of three consecutive calendar years. Any such student who continues to be enrolled or who re-enrolls after receiving the reduced fee for three years will be charged the full Nonresident Tuition that is in effect at that time.

3.13 Leaving the Program Prior to Completion of the Ph.D. Requirements:

A student admitted for the Ph.D. degree, who, in the judgment of the unit's graduate affairs committee should not continue past the master's degree, must be notified in writing by the Chair of the Graduate Group offering the degree. A copy of the letter must be sent to the Vice Provost and Dean of Graduate Education. In some cases a doctoral student may choose to leave the program with a master's degree only. It is the responsibility of the Graduate Group unit to notify the Graduate Division via the Change of Degree form so that the student's record may be updated to reflect the student's degree status. This notice must

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include the student's written permission to have his/her degree objective changed officially from doctorate to master's.

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 Graduate Division Website.