UCI Samueli School of Engineering | Department of Materials Science and Engineering

Materials Science and Engineering Graduate Student Handbook

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Preface

This handbook is intended to help you navigate your graduate studies. It summarizes useful resources, requirements for the M.S. and Ph.D. degrees, and guidance on academic progress and degree milestones. We also encourage you to participate in the department's Graduate Student Association (GSA). The MSE GSA offers opportunities to meet other students, learn from their experiences, contribute to the departmental community, and have a voice in graduate student life. Additional information and resources for UCI Engineering graduate students are available here:

https://engineering.uci.edu/current/graduate

Welcome Message from the MSE Graduate Advisor

I would like to welcome you to UC Irvine and to the graduate program in Materials Science and Engineering. Graduate study can be demanding, and the first year may feel especially challenging at times. We are committed to your success and to helping you achieve your academic and professional goals. UCI offers a range of resources to support you throughout your studies. If you feel overwhelmed, are struggling to balance competing demands, or have concerns about your mental health, contact the UCI Counseling Center at (949) 824-6457. The UCI Graduate Resource Center also provides support for professional writing, career planning, and other aspects of graduate study and professional development. (https://grad.uci.edu/)
The majority of entering MSE Ph.D. students will have already selected a research advisor after the visitation interviews and subsequent discussions. If you are in the Ph.D. program and have not matched with an advisor, I encourage you to prioritize exploring opportunities and actively engage in further discussions with potential research advisors and use any initial research rotation opportunities wisely to help you decide which research groups and advisors best meet your interests. In cases where projects can benefit from the distinct knowledge and expertise of two different faculty advisors, we strongly encourage students to explore having co-advisors.

International students are subject to UCI's spoken-English proficiency requirement, and must satisfy it by the end of the spring quarter of their first year. The current qualifying scores are: (1) 50 or higher on the TSE/SPEAK test; (2) 5 on the TOEP test; or (3) 26 or higher on the TOEFL iBT Speaking section for tests taken before January 21, 2026, or 5 or higher for tests taken on or after that date. Meeting one of these requirements establishes eligibility for a teaching assistant (TA) appointment. TA training is offered each fall, is required for MSE Ph.D. students, and must be completed before serving as a TA.

Our *Student Services Advisor*, **Rachael Lee Martin**, will be diligently forwarding you important information on required actions and deadlines – both between now and when you arrive on campus, and throughout your graduate studies. Please carefully review these communications and respond accordingly.

You can find additional guidance on steps to complete as an incoming UCI Engineering graduate student at: http://engineering.uci.edu/current/graduate/new-graduate-students

I look forward to your advancement and success as an MSE graduate student, and hope that this handbook and roadmap is helpful in navigating your pathway to your graduate degree.

Kai He
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Disclaimer and Governing Policies

This MSE Graduate Handbook provides program-specific policies, requirements, procedures, and guidance for graduate students in the Materials Science and Engineering program. It is intended to supplement, and not replace, the policies and procedures established by the UCI Samueli School of Engineering (SSOE) Graduate Handbook and the UCI Graduate Division Policies and Procedures.

In the event of any discrepancy, inconsistency, or conflict between this handbook and the policies or requirements of the UCI Graduate Division or SSOE, the policies and requirements of the Graduate Division and SSOE shall take precedence. Students are responsible for familiarizing themselves with and complying with all applicable University, Graduate Division, SSOE, and MSE requirements.

Program requirements and policies may be revised as necessary to reflect changes in the University or Graduate Division policies, accreditation requirements, or program needs. The MSE program reserves the right to interpret and update its requirements and procedures consistent with applicable UCI policies. Students should consult the most current versions of the relevant Graduate Division and SSOE policies and procedures and contact the MSE Graduate Advisor or Student Services Advisor when clarification is needed.

MSE Department Staff and Key Personnel

The main office for the Department of Materials Science and Engineering is in Engineering Tower (ET) 544. Key personnel for the MSE Graduate Program include:

- ***Professor Lorenzo Valdevit*** *Department Chair* *ET 544*
  - *Provides academic and administrative leadership for the department; oversees the delivery and quality of its undergraduate and graduate programs; leads faculty recruitment, evaluation, advancement, and other personnel matters; oversees departmental resources, including budget, staffing, and space; represents and advocates for the department with the Dean and other campus units; fosters a collegial, inclusive, and productive departmental environment; and supports the professional well-being and success of the department's faculty, staff, and students.*
- ***Professor Kai He*** *MSE Graduate Advisor* *ET 816C*
  - *Serves as the primary academic advisor for MSE graduate students and provides guidance on academic progress and milestones, coursework and curriculum, research advising, degree requirements, policies, and procedures.*
- ***Rachael Lee Martin*** *MSE Student Services Advisor* *ET 544*
  - *Serves as the primary contact for graduate-program administration and academic progress; coordinates new-student onboarding and graduate paperwork, including forms, committee and degree documentation, signatures, and exception requests; and helps students meet program milestones and deadlines.*
- ***Emily Heng*** *Chief Administrative Officer* *ET 544*
  - *Provides overall administrative leadership for the MSE Department; oversees departmental operations, budgets, academic and staff personnel, graduate-student employment and funding, and departmental resources; works with the Department Chair, Graduate Advisor, Student Services Advisor, faculty, and staff to support the graduate program; and serves as an escalation point for complex administrative matters affecting graduate students.*
- ***Katherine Guerrero*** *Academic HR Analyst* *ET 544*
  - *Coordinates graduate-student employment and personnel actions, including Graduate Student Researcher (GSR), Teaching Assistant (TA), and other appointments; processes employment and payroll documentation; administers fellowship, stipend, and other funding allocations as applicable; and assists students and faculty with questions about appointments, payroll, and graduate funding.*
- ***Viviana Saadalla*** *Administrative Officer* *ET 544*
  - *Provides front-desk, business-office, and general administrative support; assists students, faculty, and visitors with departmental inquiries; coordinates laboratory and departmental key access, conference-room reservations, and mail and package distribution; and directs students to the appropriate staff member for specialized assistance.*
- ***Darryl Mack*** *Senior Research and Development Engineer* *ET 544*
  - *Provides laboratory management, technical expertise, and engineering support; oversees teaching laboratories and supports departmental research infrastructure, equipment, and*

facilities; and assists faculty and students with laboratory operations, equipment access, technical needs, and applicable procedures.

Communication

Faculty, staff, and instructors in the department and school use email as a primary means of communication and will send important messages to your UCINetID@uci.edu address. Check this account at least once each day. You must activate your UCInetID and UCI email account. You should also review your UCI electronic directory listing and update it as needed so that faculty, students, and university staff can contact you.

Curriculum Requirements and Course Selection

Each of the graduate degree options has a selected set of curricular requirements, including a set of core/required courses. You should familiarize yourself with the *Schedule of Classes* online at UC Irvine (and learn how to explore course offerings from MSE and other campus programs):

https://www.reg.uci.edu/perl/WebSoc

Each quarter, it is recommended that you check MSE listings in the Schedule of Classes and other related disciplines (Chemistry, Physics, CBE, EngrMAE, BME, EECS, etc.) for courses of interest – especially in relation to filling out your elective course requirements.

Core Courses Required for All MSE Graduate Students

The following MSE **core courses** are REQUIRED for **all** new students in the MSE graduate degree (M.S. and Ph.D.) programs. Both the Ph.D. preliminary exam and the M.S. comprehensive exam are based, in large part, on materials covered in these required core classes. To remain in good academic standing you must enroll in and complete these core courses in the first year of your studies, in whatever quarter they are offered [note: these courses are offered only once per year].

Currently, we mandate a requirement of **five core courses**, listed below. These core courses are mandatory and cannot be waived, substituted, or replaced by another course.

MSE 200 *Structure of Materials* (Fall quarter)

MSE 256A *Mechanical Behavior of Engineering Materials* (Fall quarter)

MSE 205 *Materials Physics* (Winter quarter)

MSE 265A *Materials Thermodynamics and Statistical Mechanics* (Winter quarter)

MSE 265B *Phase Transformations and Kinetic Phenomena in Materials* (Spring quarter)

In addition, all first-year students must enroll in 6 units of MSE 298, Seminars in Materials Science and Engineering (2 units in each of the fall, winter, and spring quarters), and actively participate in the weekly departmental seminars. Ph.D. students are strongly encouraged to continue enrolling in MSE 298 each fall, winter, and spring quarter throughout the program.

Every MSE graduate student is assumed to have taken a basic "Introduction to Materials Science and Engineering" undergraduate course prior to enrolling in graduate studies in MSE here at UCI. If you have not taken such a course (e.g., your undergraduate degree was not in MSE and your degree program did not require a broad introductory materials course), you will need to take proactive steps to learn and acquire this foundational knowledge. [In this case, you are advised to discuss this with the Graduate Advisor to make plans to either learn the basic principles of MSE through self-study, or possibly enroll in a remedial undergraduate course, e.g., **ENGR 54** here at UCI]. The core courses in the MSE graduate program will assume you have an undergraduate-level understanding of the underlying subject matter.

MSE 200 – provides an understanding of the (atomic/molecular) structure of materials, and covers bonding, short-range and long-range order, key descriptors of crystalline and amorphous structure, the role of defects and imperfections, and connections of these to the properties of materials.

MSE 256A – provides a broad-based understanding of the mechanical behavior of engineering materials, and connections to the underlying atomic structure and microstructure.

MSE 205 – provides a comprehensive understanding of the electronic, optical and dielectric properties of crystalline materials, and imparts a foundational understanding of the underlying physical principles governing the properties of existing or emerging electronic and/or photonic materials.

MSE 265A – provides a foundation of advanced thermodynamics and statistical mechanics governing the structure and properties of engineering materials, principles of equilibrium, and the driving forces for materials evolution during processing or application service.

MSE 265B – provides a broad-based understanding of kinetics and non-equilibrium behavior of materials, including mass transport and phase transformations.

Elective Courses for MSE Graduate Students

MSE program graduate students are required to take additional graduate-level courses as technical electives. In addition to technical electives offered by the MSE program, students may take relevant graduate-level courses offered by other graduate programs at UCI. A list of pre-approved courses is available (Appendix IV) for students to select from.

Students who wish to take a graduate-level course that is not on the pre-approved list may request approval from the MSE Graduate Advisor. Such requests must be supported by the student's Faculty Advisor and must demonstrate that the course is relevant to the student's graduate studies.

The specific technical elective requirements vary for each of the MSE graduate degree options:

- M.S. students taking the *comprehensive exam* option are required to take 4 additional elective courses (3 units minimum per course). At least TWO of these courses must be selected from within the MSE program.
- M.S. students completing the *thesis* option are required to take 4 additional elective courses (3 units minimum per course). Up to 2 of these elective courses may be substituted by up to 8 units of MSE 296 (M.S. Thesis Research). At least TWO of these courses must be taken within the MSE program.
- Ph.D. students are required to take a total of 6 additional elective courses (3 units minimum per course). At least THREE of these courses must be selected from within the MSE program.

Possibility of Course Waiver

MSE core courses cannot be waived or substituted, regardless of whether an equivalent graduate course was completed at another institution. Students who previously completed other graduate-level MSE courses at another institution may petition to waive up to three elective courses in the MSE degree program.

To receive a waiver for an equivalent elective course taken elsewhere, students must obtain written approval from the MSE Graduate Advisor ***before the start of the quarter in which the***

corresponding UCI MSE elective course is offered. Approval must be obtained in advance; completing an equivalent course elsewhere does not automatically qualify a student for a course waiver.

Suggested Plan of Study

The suggested first-year plans, and additional (elective) course requirements, for each of the MSE degree options (M.S. Comprehensive, M.S. Thesis and Ph.D.) are outlined below.

M.S. Degree – Comprehensive Exam Option

Below is the suggested course schedule for the first year of study for students pursuing an M.S. degree via the *Comprehensive Exam* option.

YEAR 1			
	FALL	**WINTER**	**SPRING**
Core Courses *(Required)*	MSE 200 (4 units) MSE 256A (4 units)	MSE 265A (4 units) MSE 205 (4 units)	MSE 265B (4 units)
MSE Department Seminar (*Required)*	MSE 298 (2 units)	MSE 298 (2 units)	MSE 298 (2 units)
Elective Courses	**1** grad elective (≥200 level, 4 units)	**1** grad elective (≥200 level, 4 units)	**2** grad electives (≥200 level, 8 units)
Total Units	**14**	**14**	**14**

M.S. Degree – Thesis Option

Below is the suggested course schedule for the first year of study for students pursuing an M.S. degree via the *Thesis* option, wherein a research thesis is completed and defended as detailed below. The only difference in planned curriculum is that two of the elective course requirements may be substituted by research units (after consultation and planning with a research advisor).

YEAR 1			
	FALL	**WINTER**	**SPRING**
Core Courses *(Required)*	MSE 200 (4 units) MSE 256A (4 units)	MSE 265A (4 units) MSE 205 (4 units)	MSE 265B (4 units)
Research Units (*Required* for M.S. Thesis)	MSE 296 – M.S. thesis units with research advisor	MSE 296	MSE 296 (10/6 units, depending on

	(2 units)	(6/2 units, depending on enrollment in elective course)	enrollment in elective course)
MSE Department Seminar (*Required)*	MSE 298 (2 units)	MSE 298 (2 units)	MSE 298 (2 units)
Elective Courses	**1** grad elective (≥200 level, 4 units)	**0/1** grad elective (≥200 level, 4 units)	**0/1** grad elective (≥200 level, 4 units)
Total Units	**16**	**16**	**16**

Ph.D. Degree

Below is the suggested course schedule for the first two years of study for students pursuing a Ph.D. degree.

YEAR 1			
	FALL	**WINTER**	**SPRING**
Core Courses *(Required)*	MSE 200 (4 units) MSE 256A (4 units)	MSE 265A (4 units) MSE 205 (4 units)	MSE 265B (4 units)
Research Units (*Required* for Ph.D. Dissertation)	MSE 297 – Ph.D. dissertation units with research advisor (2 units)	MSE 297 (2 units)	MSE 297 (6 units)
MSE Department Seminar (*Required)*	MSE 298 (2 units)	MSE 298 (2 units)	MSE 298 (2 units)
Elective Courses	**1** grad elective (≥200 level, 4 units)	**1** grad elective (≥200 level, 4 units)	**1 grad elective** (≥200 level, 4 units)
Total Units	**16**	**16**	**16**

YEAR 2			
	FALL	**WINTER**	**SPRING**
Research Units (*Required* for Ph.D. Dissertation)	MSE 297 (12 units)	MSE 297 (12 units)	MSE 297 (12 units)
Elective Courses	**1 grad elective** (≥200 level, 8 units)	**1 grad elective** (≥200 level, 4 units)	**1 grad elective** (≥200 level, 4 units)
Total Units	**16**	**16**	**16**

Research Units

Students engaged in academic research should register for MSE 296/297/299 research units, and carefully review expectations for a satisfactory research grade with their faculty research advisor.

If you are a Ph.D. student and have formally matched with a research advisor, you will enroll in **MSE 297**: *Doctor of Philosophy Dissertation Research*. All Ph.D. students **must use** MSE 297 *after* they match with an advisor (by the end of Fall quarter of the first year of study). **Note**: Even if your research faculty advisor has a primary appointment in another department/program, and has a courtesy appointment in MSE, as MSE students, you will enroll in **MSE 297** (under that faculty member's name).

If you are an M.S. student pursuing a *thesis-based* M.S. degree, you will have the opportunity to enroll in **MSE 296**: *Master of Science Thesis Research* units. You should only enroll in MSE 296 after you and a faculty member have mutually agreed on a research project, and that faculty member has agreed to serve as your M.S. thesis advisor. For the M.S. comprehensive exam (non-thesis) M.S. option, research units do not count toward your degree.

Incoming Ph.D. students who have not yet been formally matched with a research advisor *but have arranged for a research rotation* may enroll in research units under **MSE 299**: *Individual Research*. With the expectation that you have formally matched with a research advisor by the end of the Fall quarter, you should not be enrolling in MSE 299 beyond the first quarter of your studies.

Departmental Seminar

The Department of Materials Science and Engineering hosts a weekly seminar series during the academic year, typically on Thursday afternoons. Speakers from universities, research institutions, government laboratories, and industry present emerging research across materials science and engineering. Regular attendance at departmental seminars is a critical part of your professional development throughout your graduate studies – and including this as a regular part of your weekly calendar is *highly recommended and encouraged*, throughout your time as MSE graduate students.

All full-time MSE graduate students must enroll in MSE 298, Seminar in Materials Science and Engineering, during each quarter of their first year. Students must attend at least 8 of the 10 seminars in a quarter to earn a passing grade. Attendance is recorded at each seminar.

Students are required to arrive on time, remain for the entire seminar, and conduct themselves respectfully toward the guest speaker by being attentive and engaged throughout the presentation. Students are strongly encouraged to actively participate in the seminar series by engaging with the speakers, asking questions, and taking advantage of opportunities for scientific discussion and professional interaction. The seminar series features distinguished and internationally recognized researchers from leading universities, national laboratories, and industry, whose expertise spans a broad range of materials science and engineering topics relevant to students' graduate studies and professional development.

As with any other enrolled course, cheating is academic misconduct and will be addressed accordingly. In particular, having another individual record attendance on your behalf, arriving only at the end of the seminar, or leaving early after signing in, will result in a failing grade (F) for this course, and may result in academic misconduct proceedings.

Units for Weekly Research Group Meetings

Your research advisor may also want you to add one unit of MSE 295: Seminar in Engineering, covering research group meetings. However, these units cannot be used to satisfy elective course requirements for the MSE graduate program. Check with your research advisor.

Selection of Elective Courses

Elective courses are intended to broaden your knowledge in areas relevant to your MSE studies and your research activities (M.S. thesis or Ph.D. dissertation studies). Select elective courses based on discussions with and advice received from your research advisor, to ensure that you have the needed foundational knowledge necessary to advance your research and be competitive within that research group.

Courses numbered 100 – 199 are generally undergraduate upper-division courses. They may be used to satisfy **one** elective course requirement with the MSE Graduate Advisor's approval, but only if the course is **NOT** required for the undergraduate MSE degree. In other words, the course must not serve as a remedial course for an existing deficit in UG-level MSE knowledge.

The MSE Graduate Advisor maintains a master list of pre-approved elective courses in Appendix IV of this handbook and distributes a list of upcoming elective course offerings each quarter. The courses on this list may be offered by outside programs in different quarters from year to year, and inclusion on the list does not guarantee that a course will be offered in any particular quarter. Students should check the WebReg Schedule of Classes each quarter for current course offerings and may also refer to the quarterly pre-approved elective course list distributed by the MSE Graduate Advisor or Student Services Advisor.

Students who wish to take a graduate-level course that is not included on the pre-approved list may request approval from the MSE Graduate Advisor. Such a request must be made in advance, after

consultation with and approval from the student's Faculty Advisor, and should demonstrate that the course is relevant to the student's graduate studies. Approval of an elective course not on the pre-approved list means only that the course may be counted toward the student's overall elective course requirement. **Such approval does not permit the course to substitute for or reduce the minimum number of elective courses required to be taken within the MSE program.**

When considering the use of a select undergraduate course as an elective, students should be mindful that many such courses have formal prerequisites. For graduate courses (200-level and above), the course instructors may also expect students to have completed certain courses or possess specific background knowledge, even when those courses are not listed as formal prerequisites. Students are strongly encouraged to contact the instructor of any such proposed elective course in advance to obtain permission to enroll and to discuss whether they have the appropriate background to successfully complete the course. Students should ensure that they are adequately prepared to earn a grade of B or better, as grades below B may jeopardize their academic standing in the MSE graduate program.

Graduate Standards for Grading

For graduate students, only the grades of A+, A, A-, B+, B, and S (satisfactory) represent acceptable scholarship, and only coursework in which these grades are received may be applied toward degree requirements. Students must receive a B or higher in a course in order for it to count toward their degree requirements. *An overall grade point average below the B level (3.0/4.0) is not satisfactory*; a student whose grade point average is below that level is subject to Academic Conditional Status (ACS) and potential academic disqualification. The minimum grade point standards noted here also represent minimum requirements for graduate programs at UCI.

Course Repetition

Courses in which a grade below a B, or a grade of U, was received may be repeated **only once**. Only the most recently earned grades will be used in computing the student's grade point average for the first eight (8) units of repeated graduate coursework. Thereafter, both the earlier and later grades are averaged.

Repeat of Critical Examinations

In accordance with Academic Senate policy, a graduate student shall have the option of taking a second examination in the event of unsatisfactory performance on a critical examination. Included are the comprehensive examination for Master's degrees, the Ph.D. preliminary examination, the Ph.D. qualifying examination, and the final examination on the Ph.D. dissertation (thesis defense). The second examination may have a format different from the first, but the substance should remain the same. If a graduate program changes the exam format before a student's subsequent attempt at taking the exam, the student will have the option to take the exam in the new format, where appropriate. 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. If a student is recommended for academic disqualification by the program for failing a critical exam twice, the Graduate Dean will have the sole discretion to decide

if the student will be allowed additional attempts to repeat the exam. If academic disqualification is not involved, a third examination may be given only with the approval of the departmental graduate committee and the Graduate Dean.

Grade Options

The following should be noted with regard to coursework, grading and cumulative GPA:

- **Pass/Not Pass (P/NP) Grade Option** – The grade "Pass" (P) is applied to undergraduate coursework only. It is equivalent to a grade of C level work or better and does not meet the standards for satisfactory work in a course for graduate studies. No courses graded "Pass" are to be included as part of the advanced degree program, nor are they to be considered as satisfying academic criteria for fellowships and academic appointments/employment. If a graduate student chooses the option of P/NP grading, it is assumed that the course is an elective that does not have any significant relationship to the student's progress in the graduate program. A graduate student may elect P/NP grading for one course only (a maximum of 4 units) per quarter. **Under no circumstances will courses taken P/NP count toward unit and degree requirements for any graduate degree program. However, ESL courses can be taken as P/NP and will not count toward degree requirements.**
- **Satisfactory/Unsatisfactory (S/U) Grade Option** – A grade of Satisfactory (S) is equivalent to a grade of B (3.0) or better. No credit is given for a course in which a grade of Unsatisfactory (U) was assigned. You cannot self-elect S/U grading. The S/U grading is assigned by the instructor and may be assigned to all participants in a graduate course. Similarly, individual study and research may be evaluated by means of the grades Satisfactory or Unsatisfactory.

  NOTE: When registering, your options listed include "grade" or "P/NP" only. Students taking graduate courses that offer an S/U option, and who wish to elect the S/U option, should select the "grade" option, and then make the necessary arrangements with the instructor. It is at the discretion of each individual faculty member to choose whether to utilize the letter scale (A, B, etc.) or the Satisfactory/Unsatisfactory (S, U) system when assigning grades for research classes.

  Discuss the S/U option with the instructor well before grades are assigned and consult the MSE Graduate Advisor if program approval is required. Do not assume that an informal discussion will change the grading basis recorded for the course.

Academic Standards and Satisfactory Progress

A graduate student is expected to maintain satisfactory progress toward an approved academic objective as defined by the faculty of the MSE program, and in accordance with policies of the Graduate Council and the University. It is important that your academic record be *assessed each quarter* to confirm satisfactory progress. Satisfactory progress is determined on the basis of both your recent academic record and your overall performance. In order to remain in the Ph.D. or M.S. program, all students must **maintain good academic standing,** including the following:

- **GPA –** Students must maintain a 3.0 cumulative grade point average. Additionally, a grade of B– or below in any course is considered a non-passing grade.
- **Normative Time to Degree –** Students must advance to candidacy and complete the degree within the limitations established by UCI's Graduate Council. A student exceeding the maximum time to degree shall be deemed not to be making satisfactory progress toward their degree; moreover, they shall not receive University resources (e.g., financial aid, TA-ships, housing). The Graduate Dean will not permit students to enroll past their programs' maximum time to degree. Any exception request must be made in writing directly to the Graduate Dean and will be considered in cases involving extenuating circumstances beyond the student's control. The exception request must include a plan and timeline for completion of the degree, must be signed by the student's program advisor and Associate Dean, and must be submitted at least one quarter in advance of maximum time to degree. For the MSE Ph.D. program, the normative time to advancement is three years (two years for students entering the doctoral program with a master's degree), the normative time to degree is five years (four years for students entering with a master's degree), and the maximum time to degree is seven years for all students. For the MSE M.S. program, the normative time to degree is two years, and the maximum time to degree is three years.
- **Grade Reports – All** Incomplete (I), Withdrawal (W), or No Report (NR) grades should be immediately reviewed with the instructor and MSE Graduate Advisor, and appropriate action taken as needed.
- **Enrollment Units –** students must be enrolled **for at least 12 graduate or upper-division units of credit each quarter**, including credit for supervised teaching and research, unless part-time status or an academic leave of absence has been approved in advance by the Graduate Dean. In cases of approved part-time status, enrollment in 8 or fewer units of credit toward the degree is expected each quarter.
- **Distribution of Units –** the number of upper-division and graduate-level units of credit completed toward degree requirements each quarter should be at least 8 units (for part-time) or 12 units (for full-time students) and no more than 16 units, unless an exception has been approved.
- **Residency –** time in residence prior to advancement to candidacy for the Ph.D. should be within acceptable limits (ordinarily, no more than four years).
- **Faculty Advisor –** students in MSE Ph.D. and M.S. (Thesis option) programs are required to have an individual faculty advisor throughout their graduate studies. Ph.D. students must identify and formally establish a faculty advising relationship by signing the **Advisor Verification Form** by the end of their first quarter in the Ph.D. program. Failure to establish or maintain a faculty advisor, as required by the program, constitutes unsatisfactory academic progress and may result in placement on Academic Conditional Status (ACS).

Unsatisfactory Academic Progress

A graduate student who has not demonstrated satisfactory academic progress is not eligible for any academic appointments/employment, fellowship support or other awards. Unsatisfactory academic progress may be determined based on the explicit requirements and standards outlined

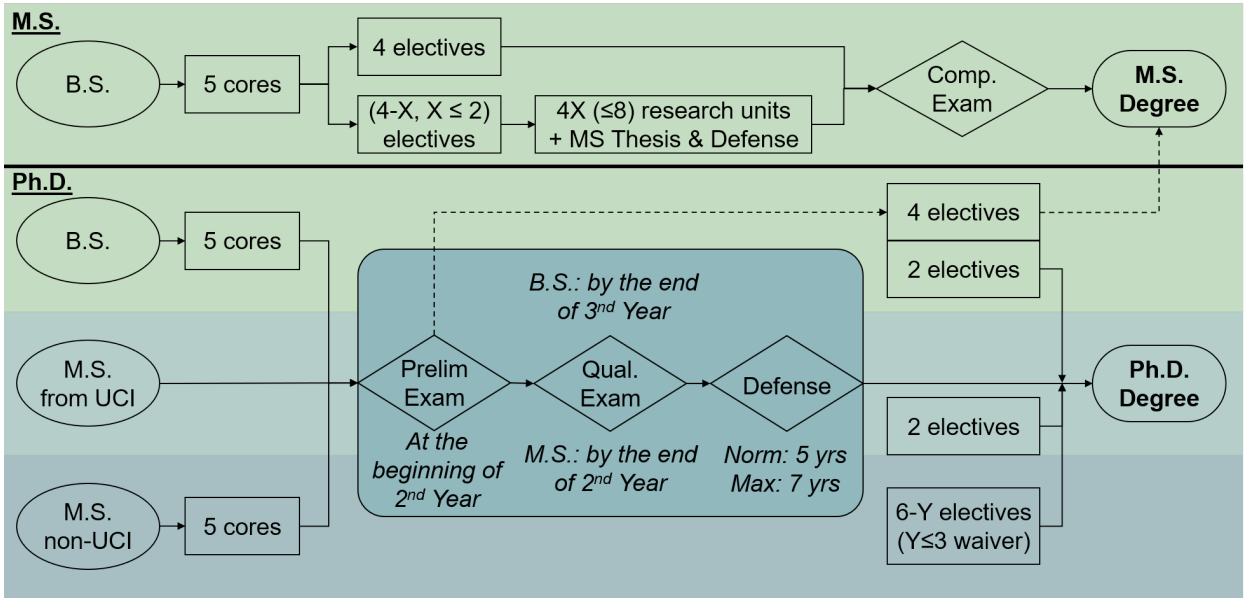
in UCI Graduate Division Policies and Procedures, as well as the academic requirements of the MSE graduate program. Examples include, but are not limited to, a deficient GPA; failure to complete required courses or milestone examinations within two attempts; failure to meet the normative time to advancement or degree; and other academic deficiencies identified by the appropriate faculty committee's evaluation.

Students determined to be making unsatisfactory academic progress will be placed on **Academic Conditional Status (ACS)**. ACS provides the student with a period of time, typically one academic quarter, or additional time when warranted, to address deficiencies and demonstrate satisfactory academic progress. The specific requirements and timeline for returning to satisfactory academic status will be outlined in an ACS contract. Students who fail to fulfill the requirements specified in the ACS contract within the established timeframe may be subject to further academic consequences, including **Academic Disqualification**, in accordance with UCI Graduate Division Policies and Procedures.

The Plan of Study Form

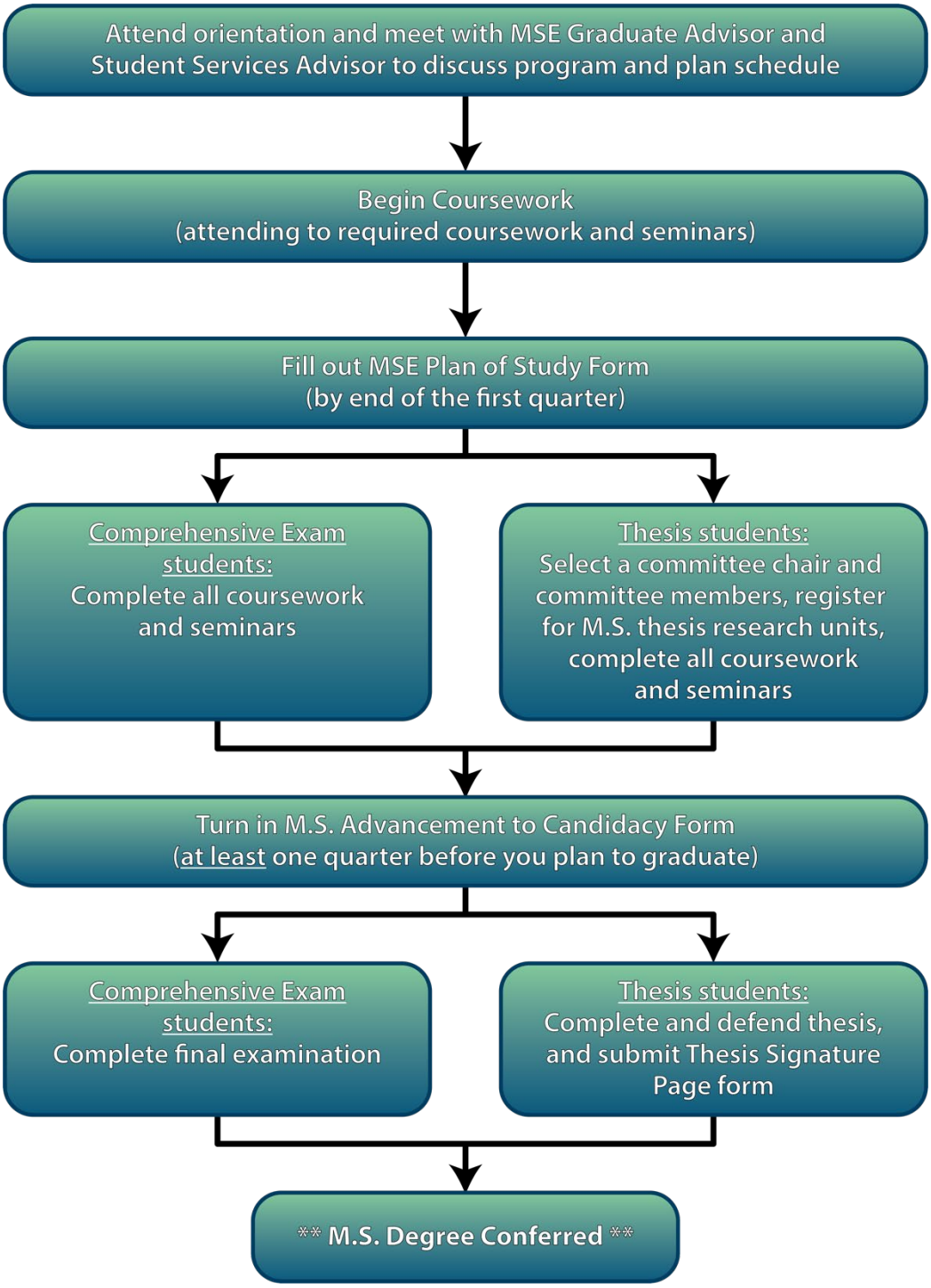
This form documents the courses that you plan to take to satisfy the curricular components of your graduate degree. You may obtain this form from the Student Services Advisor. Completion of this form is **required** for all M.S. and Ph.D. students and *must be completed by the end of the first quarter of study*. You should submit your completed form to the Student Services Advisor for approval by the Graduate Advisor. You can modify and re-file the form later if your course interests/needs change.

The following flowchart summarizing different paths to MSE M.S. and Ph.D. degrees may help you design a feasible plan of study in your graduate degree program.



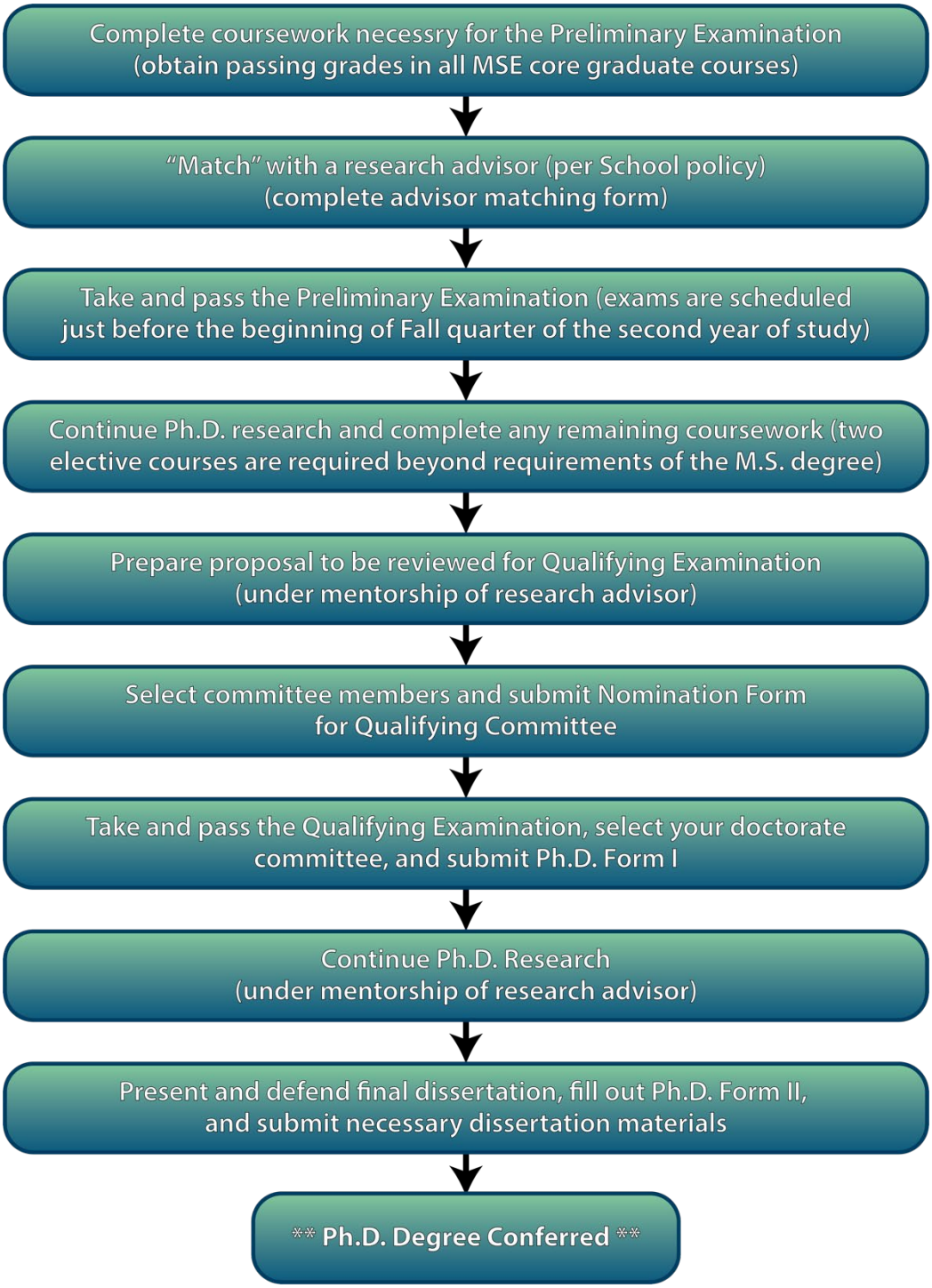
Milestones Toward MSE Graduate Degree Completion

Major Steps Toward the M.S. Degree



Major Steps Toward the Ph.D. Degree

(If earning a thesis M.S. degree along the way, follow the specific path outlined above including defending the thesis with a thesis committee; otherwise, an M.S. degree is obtained by completing the M.S. comprehensive exam option curriculum requirements outlined above, and subsequently passing the Ph.D. preliminary examination.)



Materials Science and Engineering Graduate Degree Requirements

A graduate student is expected to maintain satisfactory progress toward an approved academic objective as defined by the faculty of the MSE program, and in accordance with policies of the Graduate Council and the University. It is important that your academic record be *assessed each quarter* to confirm satisfactory progress.

M.S. Degree Requirements

General Requirements:

1. Students must file the Advancement to M.S. Candidacy form **one quarter before** the quarter in which they intend to graduate. This form must be processed via DocuSign. (Please check with and coordinate with Student Services Advisor for preparing and advancing this form for signatures.)
2. Complete the course requirements (see below for curricular details of the two M.S. degree program options).
3. Discuss early on with the Graduate Advisor and Student Services Advisor whether the M.S. comprehensive exam option or the M.S. thesis option best suits your interests. Students on the M.S./Ph.D. track may select either the thesis or comprehensive exam (preliminary exam) approach.

Option 1: M.S. Degree with the Thesis Option

This option includes original research with an advisor, a written M.S. thesis and a committee-based thesis defense.

- Must complete the **five MSE core courses** (described in more detail above).
- Must complete four additional graduate elective courses (3 units minimum/course) numbered 200-289 (or 200-295 if offered by other departments) as approved by the graduate advisor.
- Up to eight units of MSE 296 (M.S. Thesis Research) may be used to substitute for up to two elective courses. One of the elective courses may also be substituted by an upper-division undergraduate elective course, *if approved (prior to enrollment)* by the Graduate Advisor.
- All full-time students must enroll in the department seminar (MSE 298), each quarter during their first year. (A total of 3 quarters, or 6 units, are required).
- Must file the Advancement to M.S. Candidacy form at least **one quarter before graduation.**
- Must complete a **M.S. thesis**, approved and defended with a committee of 3 faculty members.
- In addition to fulfilling the course requirements outlined above, it is a University requirement for the Master of Science degree that students fulfill a minimum of 36 units of study.

General overview: 5 MSE core courses, 2 graduate electives, 8 units of M.S. thesis research, plus the M.S. thesis (written dossier and oral defense) => M.S. degree with thesis option.

Option 2: M.S. Degree with the Comprehensive Exam Option

- Must complete the **five MSE core courses** (described in more detail above).
- Must complete four additional graduate elective courses (3 units minimum/course) numbered 200-289 (or 200-295 if offered by other departments) as approved by the graduate advisor.
- All full-time students must enroll in the department seminar (MSE 298), each quarter during their first year. (A total of 3 quarters, or 6 units, are required).
- Research units do not count toward the requirements of the M.S. degree (comprehensive exam option).
- Must file the Advancement to M.S. Candidacy form at least **one quarter before graduation.**
- Must complete the written **M.S. comprehensive exam**. This exam is offered annually in the Spring quarter. Details will be provided to each student during their final quarter of study.
- In addition to fulfilling the course requirements outlined above, it is a University requirement for the Master of Science degree that students fulfill a minimum of 36 units of study.

General overview: 5 MSE core courses, 4 graduate electives, plus passing score on the M.S. comprehensive exam => M.S. degree with comprehensive exam option.

Switching to the MSE Ph.D. program: M.S. students who are interested in switching to the Ph.D. program should contact the MSE Graduate Advisor as soon as possible, to learn about the requirements and explore possibilities. The petition for the change to Ph.D. degree must be filed before the M.S. conferral.

Ph.D. Degree Requirements

Incoming Ph.D. students who have already matched with a research advisor must register for 2 to 4 units of MSE 297 under that advisor's course section. Students who have not yet matched may temporarily register for MSE 299 under the Graduate Advisor's section while completing a research rotation. After matching, students must change their enrollment to the research advisor's section of MSE 297.

- The initial core and elective course requirements are the same as those outlined for the M.S. comprehensive examination option (see above).
- Ph.D. students must take two additional elective courses beyond the M.S. degree requirements. These courses can be taken any time prior to graduation (but after the curricular requirements of the M.S. degree are completed). The two courses must be deemed relevant to the student's Ph.D. dissertation topic, be selected in consultation with the research advisor, and be subsequently approved by the MSE Graduate Advisor.
- Ph.D. students must pass the Ph.D. Preliminary Examination immediately after their first year (after the first-year coursework is successfully completed with grades of B or better).

- Ph.D. students must match with a faculty research advisor to guide their doctoral dissertation research, **no later than the end of the first quarter of the first year of study** (to remain in good academic standing).
- Students are strongly recommended to complete the E-IDP (Engineering - Individual Development Plan) form in consultation with their faculty research advisor(s) on an annual basis and submit it to the Graduate Advisor and the Student Services Advisor. The form will be provided by the Student Services Advisor.
- The Ph.D. Qualifying Examination (Advancement to Candidacy) must be completed by the end of the third year (or the second year for those admitted with M.S. degree) of study.
- The final milestone is the preparation of the written Ph.D. dissertation and the oral defense. The dissertation defense must be completed no more than 9 quarters after passing the qualifying (advancement to candidacy) exam or eligibility for financial support may be jeopardized.
- You must work with the Student Services Advisor to complete the Ph.D. advancement and dissertation paperwork. The relevant documents must be processed via DocuSign and forwarded for the necessary signatures.
- All students must enroll in a minimum of 12 units per quarter (Fall, Winter and Spring) to be considered full time (and in good academic standing as such). However, we recommend enrolling for 16 units per quarter.

Means of Support

All support for MSE graduate students is given competitively and requires maintaining good standing in the program. The general means of support are:

- Fellowships (both internal and external). Information on Fellowship opportunities will be provided through orientation sessions and informational emails. In addition, Appendix VI below provides links to fellowship opportunities.
- Research Assistantships/Graduate Student Researchers (GSR) positions, funded from faculty research grants.
- Teaching Assistantships, typically assigned on an ad-hoc basis (and at most once per year).

U.S. citizens and permanent residents should complete the FAFSA each year by the applicable priority deadline (generally March 2nd) to remain eligible for financial aid programs that require it, including federal work-study and certain fellowships. See https://studentaid.gov/h/apply-for-aid/fafsa and consult the UCI Office of Financial Aid and Scholarships for current deadlines.

Research Advisors

M.S. students taking the comprehensive exam option do not need an advisor other than the MSE Graduate Advisor. M.S. students interested in pursuing the thesis option should interface with potential research advisors as soon as possible to explore opportunities for research and advising

leading to a successful defense of an M.S. thesis. Ph.D. and M.S./Ph.D. students should match with a research advisor (or team of co-advisors) either before the start of the first quarter of study, or as soon as possible during the first quarter of study. Students having difficulty matching with an advisor should reach out to the Graduate Advisor as soon as possible for assistance. Ph.D. and M.S./Ph.D. students who do not match with an advisor by the end of the first quarter of study will no longer remain in academic good standing in the program.

Below is a list of the core MSE faculty, followed by a link where a list of MSE-affiliated faculty may be found. MSE-affiliated faculty can advise MSE graduate students, as approved by the MSE Graduate Advisor and Department Chair.

MSE Core Faculty

- **Diran Apelian:** *Solidification processing, aluminum metallurgy, clean metal/melt refining, plasma processing / spray forming, powder metallurgy, nanostructured materials, semi-solid processing, thermal processing, resource recovery and recycling, innovation in engineering education.*
- **William Bowman:** *Materials for energy conversion and storage, advanced transmission electron microscopy and spectroscopy, correlating multiscale properties, electrical properties of ceramics, electrochemistry and defect chemistry, interfaces, grain boundaries and surfaces, electron energy-loss spectroscopy, ceramic processing and thin-film growth*.
- **Stacy Copp:** *Soft matter-based photonic materials, metal nanoclusters, polymer nanostructures, self-assembly, biomimetics, machine learning for materials discovery*.
- **Ty Christoff-Tempesta:** Molecular *design, polymer chemistry, small-molecule self-assembly, macromolecular architectures, soft matter dynamics, bio-inspired materials, sustainability and health*
- **Shen Dillon:** *Materials characterization, interface science, in situ microscopy, materials for extreme environments, materials structure-properties relationships in crystalline material.*
- **James Earthman:** *Biomaterials, compositionally complex materials, nanocrystalline alloys, quantitative percussion diagnostics, deformation and damage processes*.
- **Kai He:** *Transmission electron microscopy, spectroscopy, and holography, nanostructured multifunctional materials, clean energy conversion and storage, quantum materials and devices*.
- **Allon Hochbaum:** *Biological and protein materials, electronic conductivity in proteins, and materials and methods for studying microbes and microbial communities.*

- **David Kisailus:** *Investigation of synthesis – structure and structure - property relationships in biological and biomimetic materials, development of multifunctional structural materials, synthesis and crystal growth of nanoscale materials for energy conversion, storage and environmental remediation.*
- **Elizabeth Lee:** *Computational materials and chemistry; quantum, electronic and energy materials; nanoscale transport phenomena; machine learning.*
- **Daniel Mumm:** *Materials for extreme environments, power generation and propulsion systems, inorganics for energy conversion and storage, coatings for thermal/environmental protection, additive manufacturing, materials degradation, and advanced materials characterization via electron microscopy, spectroscopy, and diffraction analysis.*
- **Xiaoqing Pan:** *Atomic-scale structure, properties and dynamic behaviors of advanced materials including thin films and nanostructures for memories, catalysts, and energy conversion and storage devices.*
- **Regina Ragan:** *Self-assembly, nanophotonic sensors for medical diagnostics and environmental monitoring, and machine-learning analysis of spectral data.*
- **Qi Song:** *Discovery of low-dimensional quantum materials through atomic-scale synthesis, spectroscopic characterization, and device development that leverages interface states and emergent quantum effects*
- **Lorenzo Valdevit:** *Architected materials, mechanical metamaterials, additive manufacturing, optimal design, materials for extreme environments.*

MSE Affiliated Faculty

For an updated list of MSE-affiliated faculty, please see the department website: https://engineering.uci.edu/dept/mse/faculty-staff/affiliated

Appendix I:
MSE M.S. Comprehensive Exam Information and Guidance

Exam Objectives

The M.S. comprehensive exam is meant to assess the breadth and depth of knowledge acquired, and to assess your ability to apply that knowledge to Materials Science and Engineering (MSE) problem solving at a level commensurate with the M.S. degree. This assessment is carried out through an exam covering topics instructed in the five MSE graduate core courses: MSE 200, MSE 205, MSE 256A, MSE 265A, and MSE 265B. The comprehensive exam also serves as the required exit examination for conferral of the M.S. degree in MSE.

Exam Format and Content

The exam will be administered in person in a two-hour time slot (specific time and location TBA every year) in the Spring quarter of each academic year. You will be allowed 2 hours to work on the exam. The exam will contain five questions covering topics of the five core courses uniformly (one question from each core course subject matter). The exam will be closed book, while students are allowed to bring their own cheat sheets (up to 5 letter-size pages in handwriting), calculators, and additional blank pages as needed in your problem solving. During the exam, students are prohibited from accessing course textbooks, course notes, or any other sources of information (online sources, etc.). Doing so would constitute a serious academic misconduct infraction.

A list of topics covered in the core courses, and relevant for this exam, are listed below.

Exam Grading and Overall Assessment

The exam has a total of 100 points with 20 points for each of the five questions. To earn a passing score (70/100 points) on the M.S. comprehensive exam, students will be expected to demonstrate a strong working knowledge in at least three of the core course subject areas and at least a minimal working knowledge in the other two subject areas.

Exam Outcome

Students will be informed of the outcome of the exam within one week after the exam.

M.S. Comprehensive Exam Topics

1. <u>Materials Structures, Imperfections and Properties</u>
   (MSE 200 – Structure of Materials, Prof. Dan Mumm)
   - Atomic structure, electron orbitals, and quantum numbers (principal, angular, momentum, spin)
   - Chemical bonding and characteristics of the different bond types
   - The periodic table, trends in bonding, properties of elements, and electronegativity
   - Crystalline material structure, and 'building' crystals from the lattice and basis

- Unit cells
- Miller indices and crystallographic directions
- Crystal systems (2D and 3D)
- 2D Bravais nets and 3D Bravais lattices
- Crystallographic computations (distances, angles, and the metric tensor)
- Reciprocal space, reciprocal lattices, the reciprocal metric tensor, and interplanar spacings.
- Symmetry elements and symmetry operations
- Point groups and space groups
- Interpreting the *International Tables of Crystallography*
- X-ray diffraction and the concept of constructive interference (Bragg's Law)
- Atomic scattering factors and structure factor calculations
- Close-packed structures, interstitial sites and interstitial filling of close-packed structures
- Common metallic and ceramic crystal structures

2. Electronic and Optical Properties
   (MSE 205 – Materials Physics, Prof. Stacy Copp)
   - Reciprocal lattice, Brillouin zone
   - Lattice vibrations: heat capacity and thermal conductivity
   - Electrical conductivity, mobility
   - Pauli exclusion principle and Fermi-Dirac distribution
   - Density of states and Fermi energy
   - Free electron Fermi gas - heat capacity and thermal conductivity
   - Electronic band structures in solids
   - Semiconductors: intrinsic/extrinsic, direct/indirect bandgap
   - Temperature dependence of conductivity of metals and semiconductors
   - Thermal transport in metals and insulators, role of defects
   - Semiconductor devices (pn junction, solar cell, MOSFET)
   - Response to electromagnetic waves: dielectrics, metals

3. Mechanical Behavior
   (MSE 256A – Mechanical Behavior of Engineering Materials, Prof. Jim Earthman)
   - Stress, Strain Definitions, Stress-Strain Curves
   - Elastic Deformation
   - Elastic Modulus, Poisson's Ratio
   - Plastic Deformation
   - Slip Planes and Slip Directions
   - Definition of Dislocations
   - Role of Dislocations in Deformation of Crystalline Solids
   - Interaction of Dislocations
   - Impeding the Movement of Dislocations
   - Methods to Detect Dislocations
   - Effect of grain size on mechanical properties of metals and ceramics (including properties of nanocrystalline materials)
   - Mechanical Behavior of Polymeric Materials

- Relative Values of E, H for metals, ceramics, polymers
- Resilience, Toughness
- Fracture Mechanics
- Stress Intensity Factor
- Fracture Toughness
- Low Temperature Behavior of Materials (Ductile to Brittle Transition)
- High Temperature Behavior of Materials (Creep)
- Fatigue
- Thermally Induced Stresses

4. Thermodynamics and Statistical Mechanics
   (MSE 265A – Materials Thermodynamics and Statistical Mechanics, Prof. Will Bowman)
   - Equilibrium and Entropy: classical thermodynamics and statistical mechanics
   - Combinatorics
   - Energy and the microscopic world: quantum theory and classical approximations
   - Microstates and microstate probabilities
   - Simple lattice models
   - The principle of equal a priori probability
   - Ensemble averages
   - Thermal equilibrium
   - The principle of maximum entropy, The Second Law
   - The fundamental equation of thermodynamics: equilibrium and derivatives of entropy
   - Extensive and intensive forms
   - The First Law
   - Baths as idealized environments
   - Thermodynamic potentials
   - Legendre transformations
   - Maxwell relations
   - Phase equilibrium and stability: conditions for phase equilibrium
   - The Clapeyron Equation
   - Stability and metastability: spinodal and binodal
   - Solutions and mixtures
   - Chemical potential
   - Interfacial tension
   - Phase diagrams

5. Phase Transformation and Kinetics
   (MSE 265B – Phase Transformations and Kinetic Phenomena in Materials, Prof. Shen Dillon)
   - Diffusion: continuum diffusion and atomic mechanisms for lattice diffusion
   - Thermodynamic driving forces
   - Nucleation and growth
   - Grain growth and coarsening
   - Spinodal decomposition and precipitation
   - Solidification
   - Grain boundaries and interfacial energy
   - Martensitic phase transformations

Appendix II:
MSE Ph.D. Preliminary Exam Information and Guidance

Exam Objectives
The MSE preliminary examination is a mandatory written and oral examination administered by the end of a Ph.D. student's first year. It evaluates the student's command of MSE fundamentals, critical-thinking skills, and ability to connect foundational knowledge to the student's research area.

Eligibility and Timeline
All MSE Ph.D. students are required to take the preliminary examination in the Spring quarter of their first year in the Ph.D. program. The examination will be scheduled by the department towards the end of the Spring quarter each year. Exceptions to this timeline may be considered by the MSE Graduate Advisor on a case-by-case basis under exceptional circumstances, such as approved off-cycle admission, approved leave of absence, or other extenuating circumstances. Students seeking an exception must submit a request to the Graduate Advisor and obtain approval before the scheduled examination.
Taking and passing the preliminary examination does not waive or replace the core course requirements. Students must still complete all five MSE core courses with a grade of B or higher to fulfill the Ph.D. degree requirements.

Exam Format
The examination consists of two parts:

1. **Written Exam**
    - **Date:** during or near the last week of spring quarter; the specific schedule will be announced
    - **Format:** 3 hours, closed book (no cheat sheet)
    - **Content:** 10 questions total (2 questions from each of the five core MSE areas), 10 points for each question
    - **Passing Score:** 70% (70/100 points)
2. **Oral Exam**
    - **Date:** during or near the last week of spring quarter; the specific schedule will be announced
    - **Format:** 1 hour total, consisting of:
        - 25 min: Student presentation
        - 25 min: Questions & answers with committee
        - 10 min: Committee discussion (student not present)
    - **Presentation Requirement:** Students should present on their own research. This may be based on:
        - Research they have conducted during their first year, **or**
        - A research overview developed from a thorough literature review in their field of endeavor.
    - As a guide for structuring a clear and impactful presentation, students should consult the **Heilmeier Catechism**, a set of eight questions designed to help researchers explain their work concisely and effectively: Heilmeier Catechism.

- **Committee:** Three faculty members (excluding the thesis advisor(s))
- **Outcome:** Pass / No Pass recommendation by the committee

Passing Requirements

- A student must pass **both the written and oral exams** to successfully complete the Preliminary Examination.
- A student who does not pass one or both parts on the first attempt will be given **one opportunity to retake only the part(s) failed.**
- The retake exams are typically scheduled at the beginning of the following Fall quarter and must be completed no later than the end of that quarter.

Exam Questions

Written examination questions are developed by MSE core course instructors and core faculty members, and cover the MSE core knowledge areas addressed by five core courses, as outlined in the M.S. Comprehensive Exam list of topics. Oral examination questions may address the student's presentation and research topics, as well as related fundamental knowledge within the MSE core areas. The questions are intended to evaluate the student's ability to communicate scientific concepts clearly, demonstrate critical thinking, and apply fundamental MSE knowledge to their research.

Exam Preparation

Students are expected to prepare for the preliminary examination with their cohorts throughout the Spring quarter, with support from MSE Graduate Student Association (GSA), as appropriate. Faculty advisors should allow students sufficient time away from research activities to prepare for the examination and study the required exam topics. To maintain the independence and fairness of the examination, faculty advisors should not be involved in their students' exam preparation beyond providing general, high-level guidance.

Appendix III:
MSE Ph.D. Qualifying Exam Information and Guidance

The purpose of the qualifying examination is to demonstrate that the student is capable of conducting independent Ph.D. research and has a viable research plan for the Ph.D. dissertation. Ph.D. faculty advisors provide guidance but do not dictate every step of research and students need to exhibit an ability for independent thinking to pass this exam. Feedback from the qualifying examination committee is very helpful in developing a viable dissertation topic and appropriate experiments.

MSE Ph.D. qualifying examination committees must comply with current Graduate Council requirements. The student and research advisor propose the committee, subject to approval by the MSE Graduate Advisor. The committee consists of five eligible faculty members; at least three must hold primary appointments in MSE. Whenever possible, committee members should have expertise relevant to the student's research area.

The Ph.D. Form I request for the qualifying examination committee must be submitted at least two weeks before the proposed examination date. The form requires multiple approvals, including that of the Associate Dean. An outside member may serve on the committee when eligible under Graduate Division policy but is not required.

For more information, check the Office of Graduate Studies website for the most current information. https://grad.uci.edu/current-students/forms-and-applications/

Normally, three members of the Qualifying Exam Committee will form your dissertation committee.

The Ph.D. qualifying examination must be completed by the end of the third year of study, or by the end of the second year for students who entered with a master's degree. If the qualifying examination is not taken by the end of Winter quarter of the 4th year, the student is no longer in good academic standing and may not be eligible for financial support. A student who cannot meet the applicable deadline must work with the faculty advisor and MSE Graduate Advisor to submit a written completion plan and request any required exception. After passing the examination and completing the required paperwork, the student advances to candidacy for the Ph.D.

There are two required parts of the qualifying examination:

I. Written Dossier
II. Oral Presentation (30–35 minutes)

The written dossier must be approved and signed off on the title page by the advisor before the dossier is distributed to the committee members and before the qualifying examination can be scheduled. You can schedule the exam before the dossier is complete, but it should be distributed to the remaining committee members a week in advance of the exam (and must have advisor signature on front, indicating approval for distribution).

I. Written Research Summary (Dossier)

Use Times New Roman 12 font, 1.5 line spacing or equivalent. Pages are approximations.

1 page	1) Title Page – Title, Name of Student, Degree Program, Date, Advisor and Advisor's Signature
1 page	2) Abstract Page – 100-word summary – include the new information obtained from experiments and/or theory/ new understanding provided to the research field/ major contribution that the dissertation will provide to the research community.
1 page	3) Introduction – brief discussion of current state of knowledge in the research field, rationale for research and how it adds to current knowledge, scientific content impact of research in technology and society, what key questions will be answered.
2-3 pages	4) Background – Extensive discussion of prior research relevant to your research should be discussed to demonstrate a knowledge of the current state of the field and the rationale for challenges addressed by your research.
3-5 pages	5) Preliminary Results – a summary of your work to date, including research methods and interpretation of data obtained by the Ph.D. candidate. Include figures, graphs, and tables and the development of any models. Explain the science and technology associated with the data.
2-4 pages	6) Future Research Plan – a thorough discussion of the experiments the student plans to complete for their dissertation. Explain how the experiments will provide critical information for the dissertation and define significant contributions to the research field.
1 page	7) Timeline – Provide an estimated timeline of when you will complete experiments, analysis, paper writing, and thesis document.
1 page	8) Summary – Summarize the new fundamental and technological research contributions that are expected from this proposed research
x pages	9) References – Author name/s, full title, journal, volume, page, year

The dossier, *excluding* References but including Figures and Tables will probably be about 15 – 25 pages. It is appropriate to change the research plan as experiments evolve, but the research plan presented in the qualifying examination serves to document the general expectations for the Ph.D.

This document can serve as a draft for the introductory chapters of the Ph.D. This document will serve as an outline for the Ph.D. dissertation, and you will save time later when writing the dissertation if you complete this properly. The introduction and background provide a good draft for the first chapter of the dissertation (with an update of the research field a few years later), and the preliminary experiments should be a draft of one chapter for the dissertation.

II. **Oral Examination**

During the oral examination the student should summarize the written document with less emphasis on published research by others than on the preliminary and future work of the examinee. This will be a presentation of approximately 30–35 minutes in length. The faculty members on the committee will question the student and offer suggestions for the Ph.D. dissertation. At least two hours should be scheduled in order to allow time for questions.

At this exam, examiners may return the Research Dossier with written suggestions in the text. The purpose of the oral exam is to evaluate the student's understanding of the proposed research and his/her ability to conduct original, independent research.

Appendix IV:
MSE Graduate Program Pre-Approved Elective Courses

The courses listed below are pre-approved technical electives for the MSE graduate program. Course offerings may vary from year to year and from quarter to quarter. Students should check the WebReg Schedule of Classes each quarter to determine which approved elective courses are offered and available for enrollment.
The MSE Graduate Advisor may revise or update this list as needed at their discretion.

All **MSE 200-level** elective courses

CBE 200 Advanced Engineering Mathematics I
CBE 249 Soft Hybrid Biomaterials
CBE 249 Catalysis
CBE 249 Electrochemical Energy
CBE 249 Electrochemical Kinetics
CBE 249 Stem Cell Tissue
CBE 249 Battery Fundamentals
CBE 272 Applied Spectroscopy
CBE 276 Nuclear and Radiochemistry
CBE 280 Advanced Polymer Science and Engineering
CBE 282 Colloid Science and Engineering

ENGRMAE 212 Engineering Electrochemistry: Fundamentals and Applications
ENGRMAE 214A Fuel Cell Fundamentals and Technology
ENGRMAE 214C PEM Fuel Cells
ENGRMAE 218 Sustainable Energy Systems
ENGRMAE 220 Conduction Heat Transfer
ENGRMAE 224 Advanced Transport Phenomena
ENGRMAE 227 Thermal Resistance Analysis in Microdevices and Nanomaterials
ENGRMAE 228 Nano Phase Transport
ENGRMAE 247 Micro-System Design
ENGRMAE 249 Micro-Sensors and Actuators
ENGRMAE 254 Mechanics of Solids
ENGRMAE 255 Composite Materials and Structures
ENGRMAE 257 Materials Failure and Fracture (MAE295)
ENGRMAE 258 Mechanical Behavior of Solids – Continuum Theories. (Prerequisite: ENGRMAE 254)
ENGRMAE 295 Introduction to Finite Elements
ENGRMAE 295 Nanoscale Fabrication and Characterization

ENGRCEE 240 High Performance Materials
ENGRCEE 242 Advanced Strength of Materials
ENGRCEE 250 Finite Element Methods for Engineering
ENGRCEE 252 Multiscale Modeling of Materials and Structures

EECS 203A Digital Image Processing
EECS 278 Micro-System Design
EECS 285C Nano Imaging

Chemistry 225 Polymer Chemistry: Synthesis and Characterization of Polymers (Prerequisites: Undergraduate courses in organic and physical chemistry)
Chemistry 239 Machine Learning
Chemistry 248 Electrochemistry
Chemistry 250 Computational Chemistry
Chemistry 263 Materials Chemistry
Chemistry 264 Analytical Methods for Organic Nanomaterials
Chemistry 267 Photochemistry

Physics 215A Quantum Mechanics
Physics 238A Condensed Matter Physics

Appendix V:
Graduate Program Learning Outcomes

(MS in Materials Science and Engineering)

I. Program Learning Outcomes

Core Knowledge. Students will be able to:

- Demonstrate general knowledge of core topics and theory in Materials Science and Engineering necessary for professional practice or Ph.D. studies.

Research Methods and Analysis. Students will be able to:

- Understand the qualitative and quantitative methodologies typically used in Materials Science and Engineering practice and research.
- Demonstrate the ability to critically analyze research literature.

Professionalism. Students will be able to:

- Demonstrate effective and professional communication.
- Commit to ethical professional conduct.

II. Assessment Plan

PLO	Direct	Indirect
Core Knowledge	- GPA≥3.0 in MSE core courses - M.S. Comprehensive Exam	Exit interview/survey
Research Methods and Analysis	- MS Thesis - Independent Study - M.S. Comprehensive Exam	Exit interview/survey
Professionalism	- Participation in Seminar Series	Exit interview/survey

III. Action Plan Timeline

PLOs are assessed at the time of graduation for each student. Data are compiled annually and used for continuous improvement of the graduate program.

(Ph.D. in Materials Science and Engineering)

I. Program Learning Outcomes

Core Knowledge. Students will be able to:

- Demonstrate general knowledge of core topics and theory in Materials Science and Engineering necessary for professional practice and/or academic research.

Scholarly Communication. Students will be able to:

- Structure a coherent academic argument that rigorously presents and evaluates research data.
- Make clear and cogent presentations, and professional documents that summarize their research and its significance.
- Communicate scientific and technical concepts effectively to diverse audiences and group sizes, using appropriate formats and levels of depth.

Independent Research. Students will be able to:

- Develop and carry out independent research projects with theoretical and methodological rigor.

Broader Impacts. Students will be able to:

- Understand the technological and societal impacts of their research.

II. Assessment Plan

PLO	Direct	Indirect
Core Knowledge	- GPA≥3.0 in MSE core courses - Preliminary Exam	Exit interview/survey
Scholarly Communication	- Research Paper - Conference Presentations - Ph.D. Defense	Exit interview/survey
Independent Research	- Qualifying Exam - Ph.D. Dissertation	Exit interview/survey
Broader Impacts	- Qualifying Exam - Ph.D. Dissertation	Exit interview/survey

III. Action Plan Timeline

PLOs are assessed at the time of graduation for each student. Data are compiled annually and used for continuous improvement of the graduate program.

Appendix VI: External Fellowship Opportunities

Current and prospective graduate students are encouraged to apply for external fellowships that they are eligible for. In addition to the list below, many governments and corporations award fellowships.

National Science Foundation Graduate Research Fellowship Program
http://www.nsfgrfp.org/

National Defense Science and Engineering Graduate Fellowship
https://ndseg.sysplus.com/

SMART Fellowship
https://www.smartscholarship.org/smart

DoE Office of Science Graduate Student Research Program
https://science.osti.gov/wdts/scgsr

DoE Computational Science Graduate Fellowship
http://www.krellinst.org/csgf/

Hertz Foundation Graduate Fellowship
http://www.hertzfoundation.org/

Graduate Fellowships for STEM Diversity
https://stemfellowships.org/

Fulbright Program
http://us.fulbrightonline.org/home.html

Appendix VII: Suggested Supplementary Reading

Current and prospective graduate students are encouraged to read or review the following, to better understand the process and expectations of pursuing an advanced degree in STEM fields.

Good Grad! A Practical Guide to Graduate School in the Sciences and Engineering
J.W. Gangestad (2013)

Survival Skills for Scientists
F. Rosei and T. Johnston (2006)

The Ph.D. Process – A Student's Guide to Graduate School in the Sciences
D.F. Bloom, J.D. Karp and N. Cohen (1998)