Materials Science and Engineering Graduate Student Handbook

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Preface

This handbook is intended to help you navigate through your graduate career development, lists useful resources, gives the requirements for each of the M.S. and Ph.D. graduate degrees, and provides guidance on all aspects of your graduate studies. We also encourage you to become active in the department's Graduate Students Association (GSA), as a means of getting to know the other students and become an integral part of the community, to learn from the experiences of those also going through the program, and to have a voice in different aspects of graduate student life. More information on the GSA, including current GSA leadership contact information, is included below. Additionally, a multitude of useful information for your graduate studies can be found here:

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

Important Information Regarding COVID-19

Your safety is our top priority. The campus is continuously working on plans, procedures and protocols to help us safely deliver the most effective educational and professional development experience to our students. As the situation is dynamic and rapidly evolving, you are encouraged to frequently monitor the updates on UCI campus responses and safety precautions, changes or modifications to our protocols and procedures, and other relevant information from campus and National health officials, by visiting the following two websites:

UCI Forward:
https://uci.edu/coronavirus/

The CDC COVID-19 Information Portal:
https://www.cdc.gov/coronavirus/2019-ncov/index.html

Welcome Message from the MSE Graduate Advisor

We would like to welcome you to UC Irvine and to the graduate program in *Materials Science and Engineering*! It is important to note that graduate studies can be stressful. The first year of graduate school may, in particular, seem very challenging and at times overwhelming. However, we are committed to your success, and have an established history of graduating highly successful students and helping them achieve their professional development goals. During their time at UCI, most of these students have found additional resources on campus that have helped them throughout their graduate studies. During your new student orientation, you have been informed of some of these additional resources and support mechanisms. I will remind you that if you feel stressed, at a loss as to how to balance competing demands on your time, or are generally concerned about your mental health, there are free campus resources designed to assist you at the *UCI Counseling Center*: (949) 824-6457. The UCI Graduate Resource Center is another excellent place to find assistance and support for effective professional writing, career planning, or general advice related to your graduate studies 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 explore having co-advisors.

If you are an international student, we will expect that you will passed the TSE/SPEAK test with a passing score of 50 or higher, or the TOEP test with a score of 5, by the end of the spring quarter of your first year (or have scored 26 or higher on the Speaking portion of the TOEFL iBT). You will have then demonstrated a good command of spoken English and will be eligible for teaching assistant (TA) appointments. TA training is offered each fall, is required for our Ph.D. students, and is mandatory for eligibility for a TA appointment.

Our *Student Services Advisor*, **Desiree Rios**, will be diligently forwarding you important information on things you need to attend to or steps you need to take – 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 a MSE graduate student, and hope that this handbook and roadmap is helpful in navigating your pathway to your graduate degree.

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MSE Departmental 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, and their roles, include:

- ***Professor Julie Schoenung*** *Department Chair* *ET 544*
- ***Professor Daniel Mumm*** *MSE Graduate Advisor* *ET 744D*
  - *Primary academic advisor for MSE graduate studies; Provides oversight of, and guidance on, all academic matters including student progress and milestones, coursework and required curriculum, research and research advising, and overall graduate degree requirements, policy and procedures.*
- ***Desiree Rios*** *MSE Student Services Advisor* *ET 544*
  - *Primary contact point for administrative aspects of graduate studies and academic progress; New student onboarding; Coordinator for all graduate paperwork (forms, exam committee and degree program documentation, signatures, exceptions, etc.) and provides oversight of rules, regulations and protocols for graduate programs; Ensures students meet program milestones and timelines/deadlines for academic progress.*
- ***Amy Ricks*** *Chief Administrative Officer* *ET 544*
  - *MSE Department Manager*
- ***Katherine Guerrero*** *Payroll and Personnel Analyst* *ET 544*
  - *Handles all appointments (GSR, TA, etc.) and handles all aspects of employment, fellowship and stipend allocations.*
- ***Viviana Saadalla*** *Administrative Officer* *ET 544*
  - *Front Desk and Business office support; Provides keys for labs, supports conference room reservations and access, and handles mail and package deliveries.*
- ***Darryl Mack*** *Research and Development Engineer* *ET 544*
  - *Laboratory manager and technical support for MSE; oversees teaching labs and departmental research infrastructure.*

Communication

The faculty, staff and instructors in the Department and School will use email as a **primary means of communication** – and will regularly send important messages to your *UCINetID@***uci.edu** email address. It is *expected* that you are checking this daily (at a minimum)! You must activate your student ID. You should also check (and modify if necessary) your electronic directory listing at UCI to ensure that you are easily contacted and e-mailed by faculty, other students, and university administrative staff.

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 and graduate degree (M.S. and Ph.D.) programs. If you have taken MSE graduate courses elsewhere (perhaps while completing an M.S. degree at another institution), you maybe able to petion for waivers for individual equivalent courses in our MSE degree program. However, in such cases, you must seek approval in writing from the Graduate Advisor – *before the start of the quarter that the program graduate core course is offered* – to receive credit for an equivalent course taken elsewhere (and be exempt from taking that core course during your studies here). 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].

This year, we are transitioning to a requirement of **five core courses**, as listed below:

MSE 200: *Crystalline Solids: Structure, Properties and Imperfections* (Fall, 2021)

MSE 256A *Mechanical Behavior of Engineering Materials* (Fall, 2021)

MSE 205 *Materials Physics* (Winter, 2022)

MSE 249* *Materials Thermodynamics and Statistical Mechanics* (Winter, 2022)

MSE 249* *Phase Transformations and Kinetic Phenomena in Materials* (Spring, 2022)

* For the 2022-2023 academic year, these courses will be listed as MSE 249 "special topics" courses. These new courses will be given permanent course numbers in future (MSE 265A and MSE 265B respectively).

In addition, all first-year students are REQUIRED to enroll in 6 units (2 units per quarter) of **MSE 298** *Seminars in Engineering* and attend (and participate in) the weekly departmental seminars (Fall, 2022, Winter 2023 and Spring, 2023).

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 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 possible enroll in a remedial undergraduate course, e.g., Engr54 here at UCI]. The core courses in the MSE graduate program will assume you have an UG-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 249 (Thermodynamics and Statistical Mechanics) – 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 249 (Kinetics and Phase Transformations) provides a broad-based understanding 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 courses as electives. The specific 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) as electives. 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) as electives, although 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.

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 a 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 249* (4 units) MSE 205 (4 units)	MSE 249† (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**

* Thermodynamics and Statistical Mechanics
† Kinetics and Phase Transformations

M.S. Degree – Thesis Option:

Below is the suggested course schedule for the first year of study for students pursuing a 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 249* (4 units) MSE 205 (4 units)	MSE 249† (4 units)
Research Units (*Required* for M.S. Thesis)	MSE 296 – M.S. thesis units with research advisor (2 units)	MSE 296 (6/2 units, depending on enrollment in elective course)	MSE 296 (10/6 units, depending on 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**

* Thermodynamics and Statistical Mechanics
† Kinetics and Phase Transformations

Ph.D. Degree:

Below is the suggested course schedule for the first two years of study for students pursuing a Ph.D. degree. In the suggested curricular plan that follows, Ph.D. students are *strongly recommended* to take the MSE 201A-B sequence, earning two units in the Fall quarter and two units in the Spring quarter. You must take *both* to earn credit for one elective course.

YEAR 1			
	FALL	**WINTER**	**SPRING**
Core Courses *(Required)*	MSE 200 (4 units) MSE 256A (4 units)	MSE 249* (4 units) MSE 205 (4 units)	MSE 249† (4 units)
Research Units (*Required* for Ph.D. Dissertation)	MSE 297 – Ph.D. dissertation units with research advisor (2 units)	MSE 297 (4 units)	MSE 297 (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 electives (≥200 level, 4 units)
Highly Recommended Elective Course Sequence for PhD Students		**MSE 201A** – Critical Analysis & Technical Communication I (2 units)	**MSE 201B** – Critical Analysis & Technical Communication II (2 units)
Total Units	**16**	**16**	**16**

* Thermodynamics and Statistical Mechanics
† Kinetics and Phase Transformations

YEAR 2			
	FALL	**WINTER**	**SPRING**
Research Units (*Required* for Ph.D. Dissertation)	MSE 297 (8 units)	MSE 297 (8 units)	MSE 297 (12 units)
Elective Courses	**2** grad electives (≥200 level, 8 units)	**2** grad electives (≥200 level, 8 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 a 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 discussing thesis research with a faculty member and mutually agreed upon a research project – and had that faculty member commit to advising M.S. thesis research with you. 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 runs a MSE departmental seminar series during the academic school year. These seminars, held weekly (typically on Thursday afternoons), provide a unique opportunity to learn about emerging research efforts of scholars from other universities and research institutions, government labs and industry. 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: *Departmental Seminar* **each quarter** of their first year. You must attend at least 8 out of the 10 seminars per quarter to obtain a passing grade, with attendance taken at the seminars. You are also required to be on time, to stay for the entire seminar, and be respectful of the guest presenter (i.e., be attentive to the seminar). As with any other enrolled course, cheating is academic misconduct and will be addressed as such. In this case, having another individual sign for your attendance, or arriving at the end of the seminar (or leaving early after signing) will result if a failing grade (F) for this course, and possible 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, 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 will distribute a list of pre-approved elective courses each quarter. These lists are curated after the schedule of classes is posted on the *WebReg Schedule of Classes* (generally shortly before the start of the enrollment period for each quarter), as many of these courses are offered outside of the MSE program; curricular decisions and offerings of these programs (EECS, MAE, CHEM, BME, etc.) are outside of the control of MSE faculty and administrators and often vary from quarter-to-quarter and year-to-year.

If you find a course you wish to take as an elective that is **not on the pre-approved list**, you should contact the MSE Graduate Advisor for approval and verification that the course will count toward the fulfillment of the degree requirements. Again, this should be done after consultation with your research advisor and strategic planning with regards to what is highest impact for advancing your graduate studies.

In considering the use of a select undergraduate course as an elective, be mindful of the fact that many of these courses have formal prerequisites. In the case of Graduate courses (≥ 200 level), the course instructors may have expectations that you have taken other courses prior to the course you are interested in (and treat those courses as "prerequisites"). You are encouraged to contact the instructor of any such proposed elective course for permission to enroll and a discussion to assess whether you will be able to successfully complete the course (with a grade of B or better, so as to not jeopardize your 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 probation and potential academic disqualification. The minimum grade point standards noted here also represent minimum requirements for graduate programs in the School of Engineering.

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

- **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.

  It is very important that you discuss this option with your instructor. Do not assume the instructor will remember this option at the end of the quarter. Please make arrangements for S/U grading well before grades are to be assigned. Moreover, grading is at the discretion of the Graduate Adviser, including whether or not to approve your request for S/U grading.

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 PhD or MS program, all students must **maintain good academic standing** including the following:

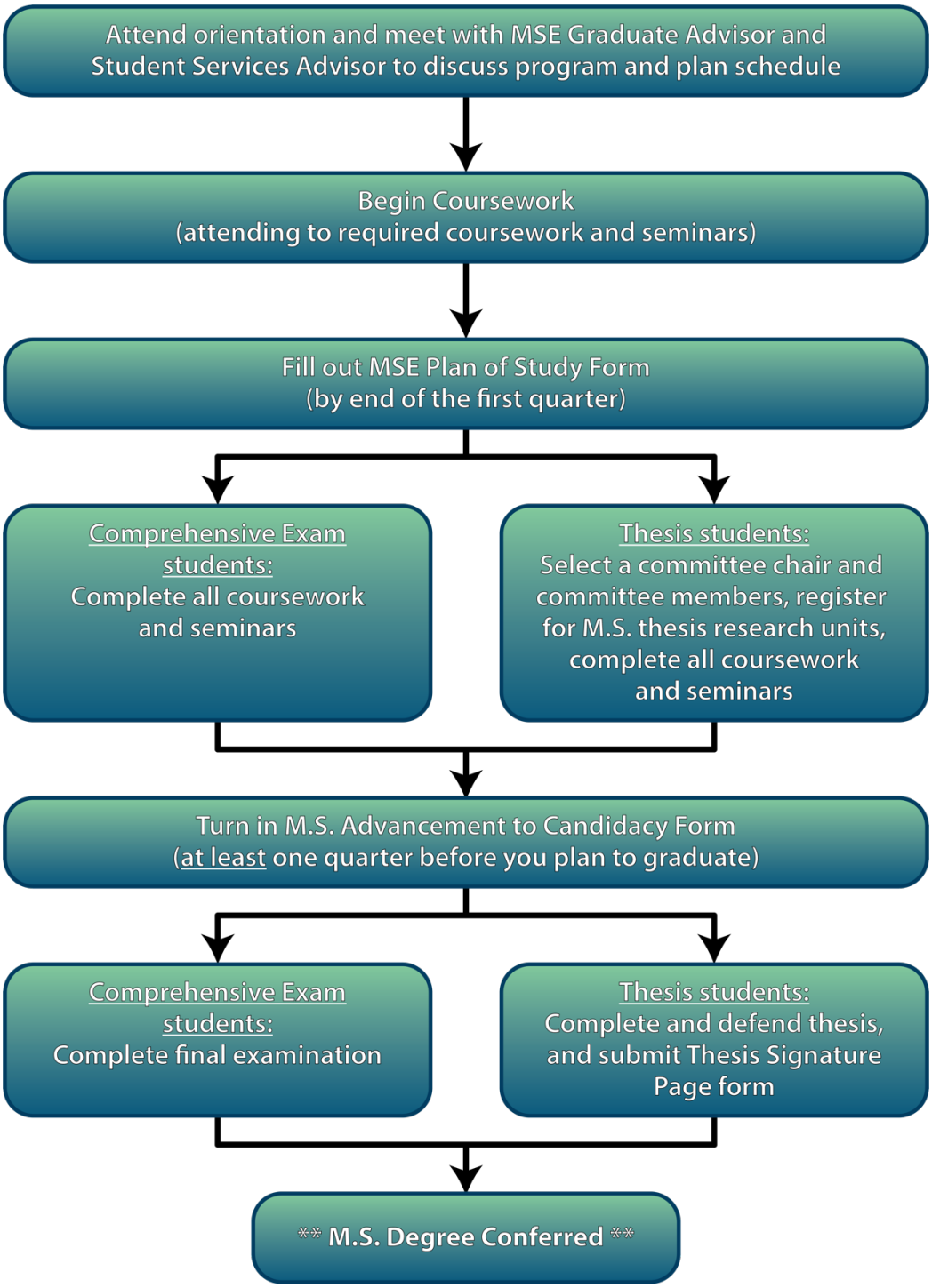
- **GPA –** you must maintain a 3.0 cumulative grade point average. Additionally, a grade of B– or below in any course is considered a non-passing grade.
- **Normative Time to Degree –** the student must advance to candidacy and complete the degree within the limitations established. A student exceeding the maximum time to degree shall be deemed not making satisfactory progress toward their degree; moreover, they shall not receive University resources (e.g., financial aid, TA-ships, housing). The normative time for completion of the Ph.D. is five years (four years for students who entered with a MSE master's degree). The maximum time permitted to complete the Ph.D. is seven 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 of 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 eight (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 PhD should be within acceptable limits (ordinarily, no more than four years).

The Plan of Study Form

This form documents and codifies 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 (Desiree Rios). Completion of this form is **required** for all M.S. and Ph.D. students, *and should 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.

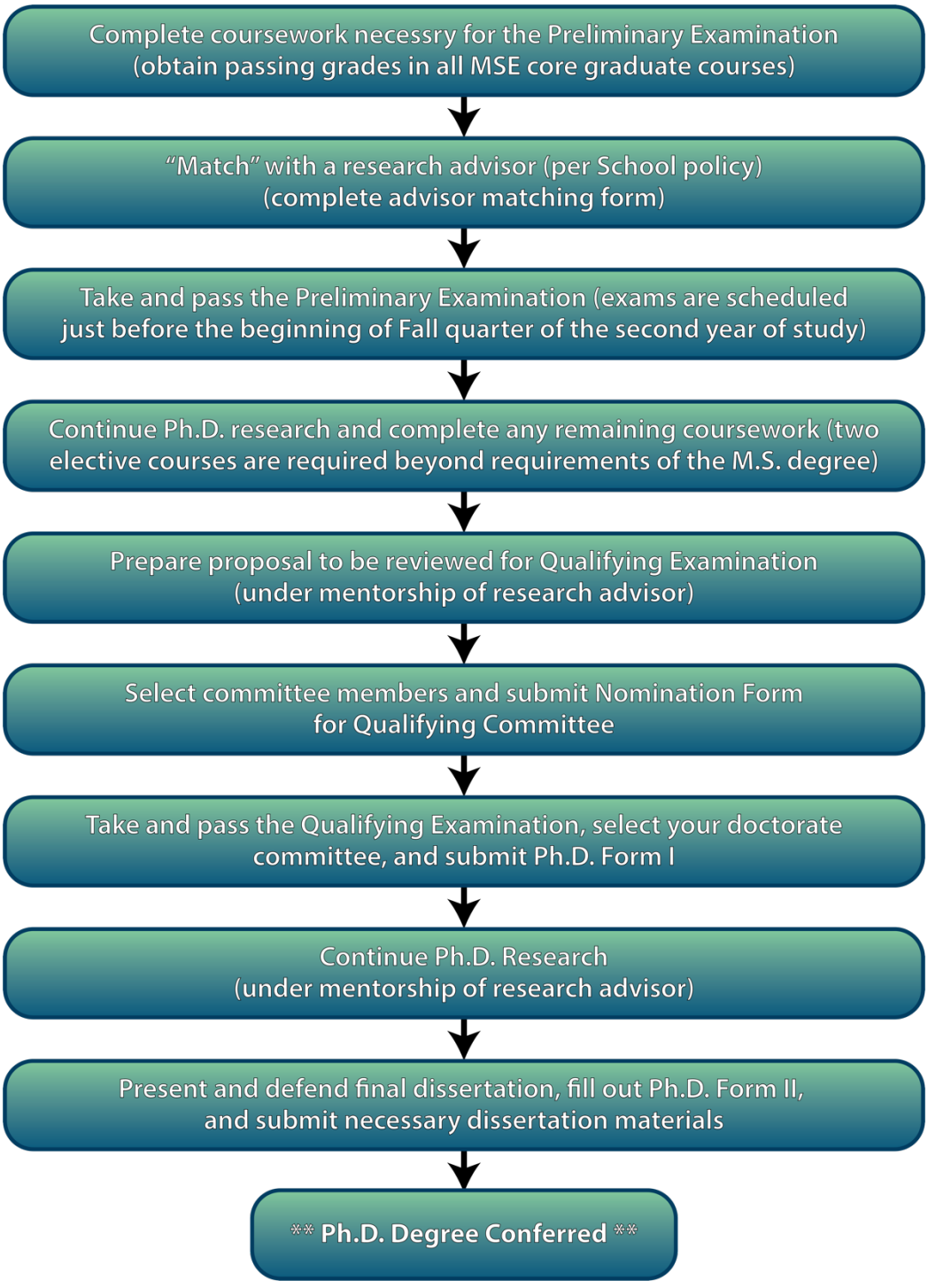
Milestones Toward MSE Graduate Degree Completion

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 you intend to graduate. This form must be processed via DocuSign. (Please check with and coordinate with Desiree Rios for preparing and advancing this form for signatures.)

[1] Complete the course requirements (see above for curricular details of the two M.S. degree program options).

[1] 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 suites your interests. Students in 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.
- All full-time students must enroll in the department seminar (as MSE 298), each quarter during their first year. (A total of 3 quarters, or 6 units, are required).
- 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.
- 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, 4 graduate electives, 8 units of M.S. thesis research, plus the M.S. thesis => 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 (as 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 graduate advisor as soon as possible, to learn about eh requirements and explore possibilities.

Ph.D. Degree Requirements –

All incoming Ph.D. students must register for 2 to 4 units of research (MSE 299). If you have directly matched with an advisor prior to starting your studies, you should register for MSE 297 units under the advisor's course section. Those of you who are not immediately matched with an advisor may temporarily sign up under the Graduate Advisor's name (Professor Mumm) as a placeholder until you have a chance to develop a match with an advisor, at which time you must electronically change (add/drop) to your research advisor's section of MSE 297.

- The initial course requirements are the same as that outlined for the M.S. comprehensive exam 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 are to be taken 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 during their first year (after the first-year coursework is successfully completed with grades of B or better).

- Ph.D. student must match with a faculty research advisor to guide their doctoral dissertation research, no later than the end of the second quarter of the first year of study (to remain in good academic standing).
- Also, to remain in good academic standing, an E-IDP (Engineering - Individual Development Plan) form must be completed in consultation with your faculty research advisor(s) and be submitted annually (by July 31st) to the Graduate Advisor and Student Services Advisor. The form will be provided by the Student Services Advisor (Desiree Rios).
- The Ph.D. Qualifying Examination (Advancement to Candidacy) should be completed by the end of the third year 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 Desiree Rios to complete the Ph.D. advancement paperwork. The relevant documents must be processed via DocuSign and forwarded for the necessary signatures.
- All students must take 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 III below provides links to fellowship opportunities.
- Research Assistantships (GSR), funded from faculty research grants.
- Teaching Assistantships, typically assigned on an ad-hoc basis (and at most once per year).

As U.S. citizens and Permanent Residents must complete the FAFSA form each year, by March 2nd, in order to be eligible for certain financial awards such as GAANN fellowships and federal Work Study awards. See https://studentaid.gov/h/apply-for-aid/fafsa.

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 be reach out to the Graduate Advisor as soon as possible for assistance. Ph.D. and M.S./Ph.D. students who are unable to "match" with an advisor by the end of the second 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.*
- **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, energy conversion and storage, quantum materials and devices.*
- **Allon Hochbaum**: *Nanoscale materials and hybrid bio-inorganic devices for applications in clean energy.*
- **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.*
- **Enrique Lavernia:** *Nanostructured materials, additive manufacturing, powder metallurgy, mechanical behavior.*
- **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:** *Exploration and development of novel material systems for nanoscale electronic and optoelectronic devices*.
- **Tim Rupert:** *Mechanical behavior, nanomaterials, structure-property relationships, microstructural stability, grain boundaries and interfaces, materials characterization*.
- **Lorenzo Valdevit:** *Architected materials, mechanical metamaterials, additive manufacturing, optimal design*.

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:
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 PhD 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:

- Participate in seminar series presented by professionals and academicians in Materials Science and Engineering and Materials Science and Engineering.

II. Assessment Plan

PLO	Direct	Indirect
Core Knowledge	-GPA≥3.0 in MSE core courses -MS Comp. exam	Exit interview / Survey
Research Methods and Analysis	-MS Thesis - Independent Study -MS comp. exam	Exit interview / Survey
Professionalism	-Participation in Seminar Series	Exit interview / Survey

III. Action Plan Timeline

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

(PhD 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.

Pedagogy. Students will be able to:

- Communicate effectively to large and small groups in pedagogical settings in lecture and/or discussion formats.

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.

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.

PLO	Direct	Indirect
Core Knowledge	-GPA≥3.0 in MSE core courses -Preliminary Exam	Exit interview / Survey
Pedagogy	-Teaching Assistantship or Tutorial Seminar	Exit interview / Survey
Scholarly Communication	-Research Paper - Conference Presentations - PhD Defense	Exit interview / Survey
Independent Research	-Qualifying Exam -PhD Dissertation	Exit interview / Survey
Broader Impacts	-Qualifying Exam -PhD Dissertation	Exit interview / Survey

II. Assessment Plan

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 II: 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