

THE GRADUATE CURRICULUM IN MATERIALS SCIENCE AND ENGINEERING

The Department of Materials Science and Engineering (MSE) at UVa offers the degrees of Master of Materials Science and Engineering (MMSE), Master of Science (MS) and Doctor of Philosophy (PhD). The MS and PhD degrees involve extensive research, leading to a thesis or dissertation, respectively. The MMSE degree does not include a thesis and is often achieved by off-grounds graduate students enrolled in the SEAS distance-learning program (CGEP: Commonwealth Graduate Education Program). The program of study for each of these degrees has been developed consistent with the principles of academic excellence as a foundation for cutting-edge research and cross-disciplinary learning. The starting point for each of the three degree programs is the MSE core curriculum.

The MSE Graduate Records Coordinator will distribute this policy statement to all entering graduate students and will assist each student in understanding the departmental requirements. In all instances a graduate student program of study is governed by the SEAS policies and guidelines presented in the Graduate Record, unless a more restrictive policy is presented below.

Upon admission to the MSE Department, students select either the MS or PhD track. The PhD stipend is received by a student after the MSE Qualifying Examination is passed, or the MS degree is attained. An MS candidate may switch to PhD status, or PhD candidate to MS status, at any time.

All MSE graduate students must complete a four-course core comprised of

- Electronic and Crystal Structure of Materials MSE 6010
- Thermodynamics and Phase Equilibria of Materials MSE 6230
- Kinetics of Transport and Transformation in Materials MSE 6240
- Defects and Microstructure in Materials MSE 6020

MS Degree

The MS degree in MSE intends for the successful student to demonstrate the ability to do independent research in engineering or applied-science with close faculty guidance. In addition to research, this degree program requires that the student achieve an overall grade point average of at least 3.0 in the 25 course credits beyond the BS level to be distributed as follows.

Course requirements for the MS degree in MSE are:

4 MSE core courses 12 credits

4 elective courses from MSE, SEAS or UVa Sci/Math 12 credits

Maximum of 2 courses at 5xxx in MSE

Maximum of 3 courses at 5xxx in total

Minimum of 2 courses in MSE beyond core

Graduate seminar 1 credit

- The program of study includes one credit of MSE seminar (MSE 7820).
- The program of study includes four electives beyond the MSE core. These electives shall be at the 5xxx, 6xxx and 7xxx levels, approved by the graduate student's advisor, and selected from SEAS-course offerings or other UVa Science/Mathematics courses. Up to six credits of 5xxx MSE courses, with a maximum of nine credits of 5xxx SEAS courses are permitted. No more than six elective credits may be earned in faculty-supervised independent study or advanced-topics courses.
- MSE 6050 and MSE 6060 may be taken for elective credit only by those students who do not have an undergraduate degree in MSE, or upon petition to the MSE Graduate Director by the graduate student's advisor.
- Students who have earned graduate course credits at UVa or at another institution may transfer up to six credits into the MSE MS program of study, provided those courses were not used to earn another degree. Transferred courses may be used to satisfy part of the MSE core requirement, if deemed equivalent by the faculty member teaching the course, or to satisfy the elective requirement, subject to approval by the MSE Graduate Director and the Associate Dean of Graduate Studies. The student must document the syllabus content of a transferred MSE core course, and the 6xxx or 7xxx level of a transferred elective course. Transferred courses may have been taken in MSE or in another field of engineering or science, but may not have been applied to achieve any other earned degree.
- The sequence in which core and elective courses are taken is defined by the student and advisor, considering that core courses provide an important foundation for elective courses and research.
- The MS degree requires at least six credits of research, under the supervision of a faculty advisor, and culminating in a written thesis that is presented and defended in a public forum.
- The four core-courses, thesis, and public defense of thesis are departmental requirements for the MS degree and cannot be waived.
- The MS candidate must write and defend publicly his/her thesis at a time that precedes the deadline for the SEAS binding receipt by at least four weeks. The

MS defense will conclude with a faculty evaluation and decision on thesis acceptability and additional requirements, if any.

- After public defense of the MS thesis, each MS student will be assessed by faculty with respect to the ability to perform graduate-level engineering research, proficiency at technical writing, and oral presentation skills.

A student's program of study for the MS degree must be approved by the MSE Graduate Director. The MSE faculty will review any appeal of this decision. Ideally, the MS degree program of study should be formalized and approved during the student's first year in the MS program.

MMSE Degree

The MMSE degree in MSE emphasizes classroom learning, and requires that the student achieve satisfactorily 30 course credits beyond the BS level.

Course requirements for the MMSE degree in MSE are:

4 MSE core courses	12 credits
6 elective courses from MSE, SEAS or UVa-Sci/Math	18 credits
Maximum of 2 courses at 5xxx in MSE	
Minimum of 2 courses in MSE, beyond core	
Maximum of 3 courses at 5xxx in total	

- MSE 6050 and MSE 6060 may be taken for elective credit only by those students who do not have an undergraduate degree in MSE, or upon petition to the MSE Graduate Director by the graduate student's advisor.
- The program of study must be approved by the MSE CGEP advisor or student's advisor, and by the MSE Graduate Director.
- Up to six credits of electives may be earned in faculty-supervised independent study or advanced topics courses. Such studies may include laboratory work.
- Each MMSE student will be assessed by faculty with respect to proficiency at technical writing, oral presentation skills and engineering analysis.

The MS degree program of study must be approved by the MSE Graduate Director. The MSE faculty will review any appeal of this decision. Ideally, the MS degree program of study should be formalized and approved during the student's first year in the MS program. CGEP students are urged to work closely with the MSE CGEP advisor to ensure an appropriate plan of study.

PhD Degree

The PhD degree in MSE intends for the successful student to produce tangible-intellectual achievement(s) from independent research at a frontier in the engineering or applied science of materials. As a foundation, the PhD degree in MSE requires that the student achieve satisfactorily at least 38 course credits beyond the BS level, and that they be distributed as follows:

Minimum course requirements for the PhD degree in MSE are:

4 MSE core courses	12 credits
8 elective courses from MSE, SEAS or UVa-Sci/Math	24 credits
Maximum of 2 courses at 5xxx in MSE	
Minimum of 4 courses in MSE beyond core	
Minimum of 2 courses in MSE at 7xxx	
Maximum of 3 courses at 5xxx in total	
Graduate Seminar	2 credits

- The program of study requires two semesters of MSE graduate seminar (MSE 7820) for a total of two credits.
- At least six of the 24 elective credits must be earned in 7xxx MSE courses at UVa.
- No more than six elective credits may be earned in faculty-supervised independent study courses. Independent study credits will not count as part of the six credits of electives at the 7xxx level.
- MSE 6050 and MSE 6060 credits may not be counted among the 24 credits of elective courses required for a PhD in MSE. Students entering the PhD program without a BS or MS in MSE are encouraged to consider taking MSE 6050 and MSE 6060 to reinforce core understanding of materials science. Students with a BS or MS in MSE should generally not take MSE 6050 or MSE 6060.
- The student's PhD committee will review his/her program of study, and advise the student and MSE Graduate Director on suggested courses beyond this minimum requirement.
- Each PhD student, with consent of the student's advisor, may petition the MSE Graduate Director to receive the MMSE degree upon completion of 30 course credits on the path to the PhD. All conditions to the MMSE degree described above apply.
- The program of study includes eight elective courses (24 credits) beyond the four MSE core courses. These electives are at the 5xxx, 6xxx and 7xxx levels, and are selected from SEAS-course offerings or other UVa Science/Mathematics courses.

- Students entering the PhD program without an MS degree may transfer up to 12 credits of graduate course work to be applied to their plan of study, provided those courses were not used to earn another degree, subject to approval by the Graduate Director and the Associate Dean of Graduate Studies.
- Students entering the PhD program with an MS degree from another institution are required to complete the four-course MSE core or to demonstrate that they have taken the equivalent courses elsewhere. Students are also required to complete four courses for credit chosen from MSE, SEAS, or UVa-Science/Math courses at the 5xxx, 6xxx, or 7xxx level. At least two of these four courses must be in MSE at the 7xxx level.
- The PhD-degree program of study must be approved by the PhD advisory committee and the MSE Graduate Director. Ideally, the degree program of study should be formalized and approved during the student's first 18-months in the PhD program.
- The PhD candidate must pass, or be declared exempt from, a preliminary core examination consisting of course material from the four MSE core courses. Students are declared exempt from the preliminary core exam if they have achieved a cumulative grade point average in the four core courses of 3.5 or higher. The student must satisfy the preliminary core exam before taking the MSE qualifying examination. The preliminary core exam is usually offered at the end of May or in early June. Most students will satisfy this requirement by the end of their first year of graduate school.
- The PhD candidate must pass a qualifying examination consisting of both written and oral components and which includes both general and comprehensive elements. All students will take the qualifying examination by the beginning of their third year of graduate school. The qualifying examination is offered every August.
- The PhD candidate must write and defend publicly a PhD dissertation proposal that is the foundation for his/her dissertation. The PhD dissertation proposal and the public defense of the PhD dissertation must occur in different semesters. It is expected that all students will have defended their PhD dissertation proposal by the end of their third year of graduate school.
- The PhD candidate must write and defend publicly his/her dissertation at a time that precedes the deadline for the SEAS binding receipt by at least four weeks. This defense will conclude with a PhD advisory committee plus faculty-only evaluation and final decision on dissertation acceptability and requirements.
- The PhD degree requires at least 25 credits of research, under the supervision of a faculty advisor, culminating in a written dissertation that is presented and defended in a public forum.

- For all PhD students, the MSE core-course foundation, qualifying examination, research proposal, dissertation, and public defense of dissertation are departmental requirements that cannot be waived.
- Recommendation: One of the eight elective courses should be math intensive, consistent with a list established by the MSE faculty¹ and allowing for transfer of an equivalent course.
- Recommendation: The PhD candidate's advisory committee should tailor the program of courses to reflect the importance of both depth and breadth in MSE.

Each PhD candidate will be assessed by faculty after public defense of the dissertation with respect to the ability to form a research plan, ability to perform original research, proficiency at technical writing, and oral presentation skills.

PhD Qualifying Exam

Preliminary Core Examination

All PhD students, including students who have earned an MS from another department or university, must pass, or be exempted from, a written preliminary examination before taking the MSE qualifying examination. The content of the preliminary core exam is based on the four MSE core courses.

The purpose of the preliminary examination is for students to demonstrate knowledge of core material. The preliminary exam is:

- Waived for students with a combined GPA of at least 3.5 in the four MSE core courses and having no course grade below a B.
- Is typically taken by PhD students in May/June of the first year following completion of the four-course core.

In preparation for the preliminary core examination, students may study independently or in groups, may use former qualifying/core exam questions, and may use material from their core courses, in addition to any other reference materials. A student who fails the preliminary core exam on the first attempt may retake the exam once at the following offering. If a student fails the preliminary core exam twice, the student will not be allowed to continue in the PhD program.

Qualifying Examination

The purpose of the qualifying examination is twofold. First, is for the student to demonstrate, through both written and oral presentation, the integration of a core body of knowledge in Materials Science and Engineering. The second purpose is for students to demonstrate the ability to apply MSE core knowledge to a research problem, including the ability to state a problem clearly, to propose a solution, to utilize the scientific literature as a means of self-learning, and to recognize the limitations and implications of the proposed work.

Each PhD student must pass, or be exempted from, the preliminary core examination before taking the MSE qualifying examination.

The PhD qualifying examination:

- Is taken by students in August, two years after enrolling with the BS
- Contains written and oral components.
- Is given over a 4 week period usually commencing in August; prior preparation for the exam is not expected.

- Emphasizes MSE knowledge synthesis and research practice including literature usage.
- Is broad, open-ended, and appropriate for a range of GRA research experience and interest.

Students enrolling with a MS degree typically take the qualifying examination within one year of beginning their PhD studies.

Students may neither consult nor work with other students during the qualifying exam. A student who fails the qualifying exam on the first attempt may retake the exam once. If a student fails the qualifying exam twice, the student will not be allowed to continue in the PhD program.

Revised 4/21/2009 WCJ